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Bulletin 24

UNION OF SOUTH AFRICA

DEPARTMENT OF MINES

THE MINERALOGY

of the

BARBERTON GOLD DEPOSITS

by

J. E. de VILLIERS, Ph.D., D.Sc.

Publication of the Geological Survey Division

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Publikasie van die Afdeling Geologiese Opname

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C.P.-S.863651—1956-7—1,200.

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THE MINERALOGY OF THE BARBERTON GOLD DEPOSITS

ABSTRACT

The gold ore from a number of localities in the Barberton Area in the Transvaal are described. Concentrates from several mines were studied with the aid of the spectrograph and the results of a few chemical analyses of these concentrates are listed. Only sulphidic ore is considered in this study.

Four main types of ore are recognised:—

(i) Ore containing arsenopyrite and pyrrhotite.
(ii) Pyritic ore.
(iii) Lead-bearing ore.
(iv) Antimonial ore.

The following is a list of the ore-minerals found: metallic antimony, arsenopyrite, berthierite, metallic bismuth, bournonite, chalcocite, chalcopyrite, cobaltite, covellite, corynite, cubanite, enargite, galena, metallic gold, jamesonite, marcasite, maucherite, niccolite, pentlandite, pyrite, pyrrhotite, metallic silver, sphalerite, stibnite, tetradymite, tetrahedrite, and violarite. The origin and paragenesis of the ore are briefly discussed.

I.—INTRODUCTION

A. Scope of Work

In 1947 the Union Department of Mines instituted an investigation of the deposits of gold ore in the Barberton District, Eastern Transvaal. The Division of the Government Mining Engineer undertook the prospecting work in conjunction with the Geological Survey which was responsible for the geological mapping and study of the minerals. The Government Metallurgical Laboratory carried out tests with regard to the beneficiation of the ore and the possible improvement of extraction-techniques.

The present study aims at giving a concise account of the results of the mineralogical investigation. No attempt has as yet been made to correlate the mineralisation with geological or structural features. The geology of the area, which is occupied by Archaean rocks, is extremely complicated and still imperfectly understood.

As the present emphasis rests on the utilisation of sulphidic ore, such ore was specially studied in this investigation.

Four main types of gold ore have been distinguished in the Barberton Area, viz. ore containing arsenopyrite and pyrrhotite, pyritic ore, lead-bearing ore, and antimonial ore. These types grade into one another and considerable variations within one type may occur. However, with a few exceptions, the ore of any one occurrence is of one type only and the various deposits will therefore be grouped under the type to which they belong and not according to geographical or geological position.

For purposes of comparison, ore-specimens from two occurrences (Mamre and Rietfontein) which are not genetically related to the Barberton deposits, were also studied.

DIE MINERALOGIE VAN DIE BARBERTONSE GOUDAFSETTINGS

SAMEVATTENDE OORSIG

Die gouderts van 'n aantal plekke in die Gebied Barberton in Transvaal word beskryf. Konsentrate afkomstig van verskeie myne, is met behulp van die spektrograaf bestudeer en die resultate van 'n paar chemiese analises van hierdie konsentrate word aangegee. Hierdie studie gaan slegs oor sulfidiese erts.

Vier hoofsoorte erts word onderskei:—

(i) Erts wat arseenpiriet en pirrotiet bevat.
(ii) Piritiese erts.
(iii) Loodbevattende erts.
(iv) Antimoonbevattende erts.

Die volgende is 'n lys van die ertsminerale wat aangetref is: gedeë antimoon, arseenpiriet, bertieriet, gedeë bismut, bournoniet, chalkosiet, chalkopiriet, covelliet, enargiet, galeniet, gedeë goud, jamesoniet, kobaltiet, koriniet, kubaniet, markasiet, maucheriet, nikkeliet, pentlandiet, piriet, pirrotiet, sfaleriet, gedeë silwer, stibniet, tetradimiet, tetraëdriet, en violariet. Die oorsprong en paragenese van die erts word kortliks bespreek.

I.—INLEIDING

A. Omvang van Werk

In 1947 het die Departement van Mynwese van die Unie 'n ondersoek van die afsettings van gouderts in die Distrik Barberton, Oos-Transvaal, onderneem. Die Afdeling Staatsmyningenieur het die prospekteerwerk onderneem in samewerking met die Geologiese Opname wat die geologiese kartering en bestudering van die minerale waargeneem het. Die Staatsmetallurgielaboratorium het toetse uitgevoer met betrekking tot die benefisiëring van die erts en die moontlike verbetering van ekstraksietegnieke.

Die doel van die huidige studie is om 'n beknopte verslag van die resultate van die mineralogiese ondersoek te gee. Geen poging is tot dusver aangewend om die mineralisering met geologie of struktuurtrekke te korreleer nie. Die geologie van die gebied, wat deur Argeïese gesteentes beslaan word, is baie ingewikkeld en word nog nie ten volle verstaan nie.

Aangesien die benutting van sulfidiese erts op die oomblik hoofsaak is, is spesiale aandag aan die bestudering van dié erts in hierdie ondersoek gewy.

Daar is vier hoofsoorte gouderts in die Gebied Barberton onderskei, nl. erts wat arseenpiriet en pirrotiet bevat, piritiese erts, loodbevattende erts, en antimoonbevattende erts. Hierdie soorte gaan in mekaar oor en aansienlike variasies kan binne een bepaalde soort voorkom. Op enkele uitsonderings na bestaan die erts van iedere afsonderlike voorkoms egter net uit een soort, en die verskillende afsettings word dus gegroepeer by die soort waartoe hulle behoort, en nie volgens geografiese of geologiese posisie nie.

Vir doeleindes van vergelyking is ertsmonsters van twee voorkomste (Mamre en Rietfontein) wat nie geneties aan die afsettings van Barberton verwant is nie, ook bestudeer.

B. Methods of Study

Most of the occurrences were visited and sampled by the writer during 1948 and 1949, and selected specimens were polished and examined under the ore-microscope. The number of sections so studied varied from about twenty-five in the case of the New Consort Mine to three or four in the case of small or abandoned properties. The above method was, as a matter of routine, supplemented by examination under the petrographic and binocular microscopes. A Leitz microphotometer was used to measure the reflectivity of individual grains. Whenever possible, samples of gold concentrates were also obtained from the mines and these were studied with the aid of a Hilger spectrograph of the Littrow type. Several samples of concentrates were submitted to the Division of Chemical Services for analysis for selected constituents and these results are given on page 44.

The spectrograph proved to be particularly useful for the rapid analysis of very small samples. A dental drill was employed to drill out small mineral grains that had been located under the microscope, and the resulting powder was transferred to an electrode and arced in the spectrograph.

Several minerals were identified with the aid of X-ray photographs. The lines of the X-ray patterns were measured and the " d-values " calculated. These values were then compared with those given in Harcourt's (3)* tables or in the sets of cards published by the American Society for Testing Materials (A.S.T.M.) (1).

C. Previous Work

The only comprehensive work dealing with the geology of the Barberton District that has appeared in the past, is the memoir by A. L. Hall (2) published in 1918. Subsequently O. R. van Eeden (11) described the geology of the Sheba Hills and in 1943 M. G. Hearn (4) gave an account of the geology and mineralogy of the New Consort and Sheba Mines. More recently, in 1947, G. M. Koen (5) surveyed and described a portion of the Sheba area.

D. Acknowledgments

The author is indebted to Mr. G. K. Joubert, Dr. L. G. Boardman, and Dr. C. A. Strauss, who assisted in the collection of the samples, and to Drs. O. R. van Eeden and B. Wasserstein who, in addition to those mentioned above, have shown unfailing interest in the work and have offered many helpful suggestions. The assistance of mine managers and officials is greatly appreciated.

II.—ORE WITH ARSENOPYRITE AND PYRRHOTITE

A. New Consort Mine

The material obtained from this important mine, which is situated near Noordkaap Siding, consists mostly of biotite with varying amounts of one or more of the following minerals: Amphibole, chlorite, quartz, albite-oligoclase, tourmaline, and sulphide. A few specimens consist mainly of

* The figures in brackets refer to the bibliography at the end of this publication.

B. Studiemetodes

Die skrywer het die meeste voorkomste gedurende 1948 en 1949 besoek en daar monsters geneem; hiervan is sekeres uitgekies, gepoleer en onder die ertsmikroskoop ondersoek. Die aantal gepoleerde ertsstukke wat aldus bestudeer is, het gewissel van ongeveer vyf-en-twintig in die geval van die New Consortmyn tot drie of vier in die geval van klein of verlate eiendomme. As roetinesaak is bogenoemde metode aangevul deur ondersoek onder die petrografiese en binokulêre mikroskope. 'n Leitzmikrofotometer is gebruik om die reflektiwiteit van indiwiduele korrels te meet. Waar moontlik is monsters van goudkonsentrate ook van die myne verkry en met behulp van 'n Hilgerspektrograaf van die Littrowtipe bestudeer. Verskeie monsters van konsentrate is na die Afdeling Skeikundige Diens gestuur vir analise vir bepaalde bestanddele en hierdie resultate word op bladsy 45 aangegee.

Die spektrograaf was baie nuttig om besonder klein monsters vinnig te analiseer. 'n Tandboor is gebruik om klein mineraalkorrels wat onder die mikroskoop bespeur is, uit te boor en die poeier wat verkry is, is op 'n elektrode oorgeplaas en in die spektrograaf vergloei.

Verskeie minerale is met behulp van X-straalfoto's geïdentifiseer. Die lyne van die X-straalpatrone is gemeet en die „d-waardes" bereken. Hierdie waardes is vervolgens vergelyk met dié wat aangegee is in Harcourt (3)* se tabelle of in die stel kaarte wat deur die American Society for Testing Materials (A.S.T.M.) (1) gepubliseer is.

C. Vorige Werk

Die enigste omvattende werk oor die geologie van die Distrik Barberton wat in die verlede verskyn het, is die memorie deur A. L. Hall (2) wat in 1918 gepubliseer is. Sedertdien het O. R. van Eeden (11) die geologie van die Shebaheuwels beskryf en in 1943 het M. G. Hearn (4) 'n verslag van die geologie en die mineralogie van die New Consort- en die Shebamyn laat verskyn. Meer onlangs, in 1947, het G. M. Koen (5) 'n opname van 'n gedeelte van die Shebagebied gemaak en dit beskryf.

D. Dankbetuigings

Die skrywer is dank verskuldig aan mnr. G. K. Joubert, dr. L. G. Boardman, en dr. C. A. Strauss wat met die versameling van monsters behulpsaam was, asook aan dr. O. R. van Eeden en dr. B. Wasserstein wat, tesame met bogenoemdes, groot belangstelling in die werk getoon en baie waardevolle wenke gegee het. Die hulp verleen deur mynbestuurders en -beamptes word hoog op prys gestel.

II.—ERTS MET ARSEENPIRIET EN PIRROTIET

A. New Consortmyn

Die materiaal verkry van hierdie myn wat naby Noordkaapsylyn geleë is, bestaan hoofsaaklik uit biotiet met wisselende hoeveelhede van een of meer van die volgende minerale: Amfibool, chloriet, kwarts, albiet-oligoklaas, toermalyn, en sulfied. 'n Paar monsters bestaan hoofsaaklik uit kwarts en

* Die syfers tussen hakies het betrekking op die bibliografie agterin hierdie publikasie.

quartz and felspar while samples composed of quartz and small seams of green chromiferous muscovite were also found. The chlorite forms smooth surfaces on many of the specimens; in rare cases a thin film of gold (paint-gold) was seen to coat such surfaces.

The sulphide commonly visible in hand-specimens consists of pyrrhotite and arsenopyrite; the former occurs as irregular patches and veinlets while the latter has a strong tendency to form individual needles a few millimetres in length. In certain specimens composed of quartz, amphibole, and chlorite, the arsenopyrite is arranged in irregular layers parallel to the planes of cleavage of the chlorite. Apart from " paint-gold ", visible gold in the form of small irregular grains and veinlets is not uncommon in ore from the New Consort Mine.

Under the ore-microscope *arsenopyrite* shows its usual tendency to euhedralism but many crystals are corroded or broken. *Pyrrhotite* is found in intimate association with arsenopyrite but the two minerals may also occur separately.

Small veins of pyrrhotite are common in arsenopyrite. As a result of deformation, the harder arsenopyrite occurs as bent and broken fragments, whereas the softer pyrrhotite flowed around grains of other minerals.

Chalcopyrite was only rarely visible to the naked eye. It could, however, be found in most of the polished sections that contain pyrrhotite and it is intimately associated with this mineral. It occurs as small, irregular grains, a tenth of a millimetre or less in diameter, or as veinlets.

In very rich samples, *gold* occurs in all the ore and gangue minerals, and is mainly coarse, many of the grains having a diameter of more than one tenth of a millimetre. In the leaner ore, most of the gold occurs in arsenopyrite; the bulk of the metal has a particle size greater than 10 microns.

Small feather-like bodies (average size about $10\mu \times 100\mu$) of *pentlandite*, formed by exsolution from pyrrhotite, were observed in a few polished sections. The pentlandite has normal properties, its reflectivity having been determined as green 41·9 per cent, red 39·6 per cent (in oil). In carrying out the etch-tests, the procedure recommended by Short ([9]) was followed. The pyrrhotite in which the pentlandite is present was analysed spectrographically and it gave a strong test for nickel.

Niccolite was found in one specimen of very rich gold ore where it occurs in association with arsenopyrite. The largest grains have a diameter of about 0·05 millimetres and the mineral has normal properties, its reflectivity having been determined as green 37·2 per cent, red 45·9 per cent (in oil). Tests by means of the spectrograph showed nickel to be a major constituent.

A single grain of *maucherite*, partially enclosed in niccolite, was identified.

In the same specimen in which niccolite and maucherite were found, a mineral of low reflectivity was observed which occurred in a veinlet of gold and in intimate association with this metal. It is probably the mineral *trevorite*, $(Ni, Fe)_3O_4$, described by F. C. Partridge ([7]).

A few small grains up to 30 microns in diameter, of metallic *bismuth* were found in one specimen. The grains occur in arsenopyrite together with grains of gold with which some of them are in contact. The reflectivity

veldspaat, terwyl monsters wat saamgestel is uit kwarts en klein aartjies groen chroombevattende muskoviet, ook aangetref is. Die chloriet vorm gladde oppervlaktes op baie van die monsters en in seldsame gevalle is daar gesien dat 'n dun lagie goud („ nerfgoud ") hierdie oppervlakte bedek.

Die sulfied wat gewoonlik in handmonsters sigbaar is, bestaan uit pirrotiet en arseenpiriet. Eersgenoemde kom voor in die vorm van onreëlmatige kolle en klein aartjies, terwyl daar by laasgenoemde 'n sterk neiging is om indiwiduele naalde wat 'n paar millimeter lank is, te vorm. In sekere monsters wat uit kwarts, amfibool, en chloriet bestaan, is die arseenpiriet in onreëlmatige lae parallel met die kliewingsvlak gerangskik. Benewens „ nerfgoud " is sigbare goud in die vorm van klein, onreëlmatige korrels en aartjies nie ongewoon in die erts van die New Consortmyn nie.

Onder die ertsmikroskoop toon *arseenpiriet* sy gewone neiging tot eievormigheid, maar baie kristalle is gekorrodeer of gebreek. *Pirrotiet* word in baie noue assosiasie met arseenpiriet aangetref, maar die twee minerale kan ook afsonderlik voorkom.

Klein pirrotietaartjies word algemeen in arseenpiriet aangetref. Ten gevolge van deformasie kom die harder arseenpiriet in die vorm van gebuigde of gebreekte brokke voor, terwyl die sagter pirrotiet óm korrels van ander minerale gevloei het.

Chalkopiriet was selde met die blote oog sigbaar. Dit was egter in die meeste van die gepoleerde ertsstukke wat pirrotiet bevat, bespeurbaar en staan in noue assosiasie met hierdie mineraal. Dit kom voor in die vorm van klein, onreëlmatige korrels, 'n tiende van 'n millimeter of minder in diameter, of in die vorm van aartjies.

In besonder ryk monsters kom *goud* in al die erts en aarsteenminerale voor en is dit hoofsaaklik grof met baie korrels wat 'n diameter van meer as een-tiende van 'n millimeter het. In armer erts kom die meeste van die goud in arseenpiriet voor; die grootte van die deeltjies waaruit die massa van die metaal bestaan is meer as 10 mikron.

Klein veervormige liggame (gemiddelde grootte ongeveer $10\mu \times 100\mu$) van *pentlandiet* wat deur ontmenging uit pirrotiet gevorm is, is in 'n paar gepoleerde ertsstukke opgemerk. Die pentlandiet het normale eienskappe en die reflektiwiteit daarvan is vasgestel op groen 41·9 persent, rooi 39·6 persent (in olie). By die uitvoering van die ertstoetse is die prosedure wat deur Short (9) aanbeveel word, gevolg. Die pirrotiet waarin die pentlandiet voorkom, is spektrografies ontleed en het sterk op die toets vir nikkel gereageer.

Nikkeliet is in een monster van baie ryk gouderts gevind waar dit in assosiasie met arseenpiriet voorkom. Die grootste korrels het 'n diameter van ongeveer 0·05 millimeter en die mineraal het normale eienskappe, met 'n reflektiwiteit wat vasgestel is op groen 37·2 persent, rooi 45·9 persent (in olie). Toetse met behulp van die spektrograaf het getoon dat nikkel een van die hoofbestanddele is. Één enkele korrel *maucheriet* gedeeltelik in nikkeliet omsluit is geïdentifiseer.

In dieselfde monster waarin nikkeliet en maucheriet aangetref is, is 'n mineraal met 'n lae reflektiwiteit opgemerk; dit kom in 'n goudaartjie voor en is nou met hierdie metaal geassosieer. Dit is waarskynlik die mineraal *trevoriet*, $(Ni, Fe)_3O_4$, wat deur F. C. Partridge (9) beskryf is.

'n Paar klein korrels van gedeë *bismut*, tot 30 mikron in diameter, is in een monster aangetref. Die korrels kom in arseenpiriet saam met goudkorrels voor, waarmee sommige van hulle in kontak is. Die reflektiwiteit

of the mineral (in oil) is: green 53 per cent, red 51·6 per cent. Individual grains were too small to drill out, but a spectrographic test for bismuth carried out on the arsenopyrite gave a positive result.

Finally, in one specimen, a very small amount of *galena* was found which was interstitial to crystals of arsenopyrite.

Antimonial ore from the New Consort Mine is described on page 34.

B. Lily Mine

The Lily Mine is located about three miles south of Louw's Creek Siding. Only a few samples were obtained from this property which has been abandoned for many years. The weathered material is in part banded, and is composed of amphibole with smaller amounts of fine-grained quartz, chlorite, white clayey material, tourmaline, sulphide, and unidentified weathering-products. The sulphide present comprises pyrrhotite, arsenopyrite, " melnikovite-pyrite " ([8]), and a small amount of chalcopyrite.

The pyrrhotite is concentrated in irregular bodies or arranged in rude bands. It is interstitial to laths of amphibole and is also crowded with inclusions of this mineral. Like pyrrhotite, arsenopyrite may form bands in the ore. Fairly massive, if somewhat weathered, arsenopyrite was also noted.

Under the ore-microscope, *arsenopyrite* is seen to be present as grains most of which are corroded and broken. Irregular grains of *pyrrhotite* and veins of *melnikovite-pyrite* occur as inclusions in the arsenopyrite. The melnikovite-pyrite has a finely granular structure. Its colour varies from the yellow of pyrite to a dull brown and its hardness is likewise variable, some fragments being slightly harder and some softer than arsenopyrite. The presence of spheroidal contraction-cracks and concentric markings, which represent differences in hardness, indicate that the substance was probably deposited in colloidal form. The mineral is undoubtedly an alteration-product formed in the zone of weathering and its manner of occurrence in the ore suggests that the original mineral was probably, in largest part, pyrrhotite. Schneiderhöhn and Ramdohr ([8]) state that melnikovite-pyrite has the crystal structure of pyrite. Small amounts of *chalcopyrite* occur in the pyrrhotite as irregular patches and veinlets, and *magnetite* is present as small grains, forming cores in many grains of pyrrhotite.

One grain of *gold*, about 20 microns in diameter was found in arsenopyrite and another very small particle (about 2μ in diameter) was seen in melnikovite-pyrite.

C. Eagle's Nest Mine

The Eagle's Nest Mine is situated about 8 miles south of Sheba Siding. When the writer visited the property in 1949, development work was going on but the mine was not producing.

The samples collected consist of carbonaceous shaly and schistose rocks with veins of dark-coloured chert and quartz which lie mostly in the plane of schistosity. The ore contains a particularly high percentage of sulphide and some dolomite which is associated with the " chert ". Veins of white quartz, younger than the ore, are present in a few specimens.

van die mineraal (in olie) is: groen 53 persent, rooi 51·6 persent. Individuele korrels was te klein om uit te boor, maar 'n spektrografiese toets vir bismut wat op arseenpiriet uitgevoer is, het 'n positiewe uitslag opgelewer.

Ten slotte is daar in een monster 'n baie klein hoeveelheid *galeniet* tussen die arseenpirietkristalle aangetref.

Antimoonbevattende erts van die New Consortmyn word op bladsy 35 beskryf.

B. Lilymyn

Die Lilymyn is sowat drie myl ten suide van die Louw's Creeksylyn geleë. Van hierdie eiendom wat baie jare gelede reeds verlaat is, is slegs 'n paar monsters verkry. Die verweerde materiaal is gedeeltelik gestreep en bestaan uit amfibool met kleiner hoeveelhede fynkorrelrige kwarts, chloriet, wit kleiagtige materiaal, toermalyn, sulfied, en ongeïdentifiseerde verweringsprodukte. Die sulfied wat voorkom, bestaan uit pirrotiet, arseenpiriet, „ melnikoviet-piriet " ([8]) en 'n geringe hoeveelheid chalkopiriet.

Die pirrotiet is in onreëlmatige liggame gekonsentreer of min of meer in bande gerangskik. Dit vorm tussenkorrels tussen die amfiboollatjies en bevat ook 'n groot aantal insluitsels van hierdie mineraal. Soos pirrotiet, vorm arseenpiriet ook soms bande in die erts. Betreklik massiewe, ofskoon effens verweerde, arseenpiriet is ook opgemerk.

Onder die ertsmikroskoop kan daar gesien word dat *arseenpiriet* voorkom in die vorm van korrels waarvan die meeste gekorrodeer en gebreek is. Onreëlmatige korrels *pirrotiet* en are van *melnikoviet-piriet* kom in die vorm van insluitsels in die arseenpiriet voor. Die melnikoviet-piriet het 'n fyn korrelstruktuur. Die kleur daarvan varieer tussen die geel van piriet en 'n dowwe bruin en insgelyks varieer die hardheid sodat sommige brokke effens harder en ander sagter as arseenpiriet is. Die aanwesigheid van sferoïdale krimpbarste en konsentriese merke wat verskille in hardheid verteenwoordig, dui aan dat die stof waarskynlik in kolloïdale vorm afgeset is. Die mineraal is ongetwyfeld 'n veranderingsproduk wat in die verweringsone gevorm is en volgens sy voorkomswyse in die erts wil dit voorkom asof die oorspronklike mineraal na alle waarskynlikheid grotendeels pirrotiet was. Schneiderhöhn en Ramdohr ([8]) verklaar dat melnikoviet-piriet die kristalstruktuur van piriet het. Klein hoeveelhede *chalkopiriet* kom in die pirrotiet voor in die vorm van onreëlmatige kolle en aartjies en *magnetiet* kom voor in die vorm van klein korrels en maak die kerns van baie pirrotietkorrels uit.

Een korrel *goud*, ongeveer 20 mikron in diameter, is in arseenpiriet aangetref en 'n ander baie klein korrel (ongeveer 2μ in diameter) is in melnikoviet-piriet opgemerk.

C. Eagle's Nestmyn

Die Eagle's Nestmyn is ongeveer 8 myl ten suide van Shebasylyn geleë. Toe die skrywer die eiendom in 1949 besoek het, was ontsluitingswerk aan die gang, maar die myn het nie geproduseer nie.

Die monsters wat versamel is, het bestaan uit koolstofbevattende skalieagtige en skisagtige gesteentes met are van donkerkleurige chert en kwarts wat hoofsaaklik in die skisteusheidsvlak lê. Die erts bevat 'n besondere hoë persentasie sulfied en 'n hoeveelheid dolomiet wat met die „ chert " geassosieer is. Are van wit kwarts wat jonger as die erts is, kom in 'n paar monsters voor.

The ore-minerals form irregular veins and lenses and some specimens present a streaky and banded appearance. The sulphidic minerals present are pyrite, arsenopyrite, and pyrrhotite with traces of chalcopyrite—the ore thus occupies an intermediate position between the arsenopyrite-pyrrhotite type and the pyrite type. Pyrite is the mineral most abundantly present. Arsenopyrite is not plentiful but is nevertheless present while pyrrhotite plays a relatively minor role.

The pyrite and arsenopyrite tend to occur in separate bands and patches. They may form fairly massive bodies with little interstitial quartz or dolomite, or they may be present as separate crystals scattered fairly evenly through the matrix of the gangue. Occasionally crystals of arsenopyrite are found in large bodies of pyrite and the former mineral commonly contains very small rounded or irregular grains of pyrite. All the minerals have been intensely fractured and recrystallised. According to the observations pyrrhotite may be considered younger than arsenopyrite, and pyrite younger than both, but this relationship may be due to recrystallisation and metamorphism.

Pyrrhotite is present as fairly well-defined bands or as bodies of irregular shape. It shows no tendency to appear as euhedral crystals. In part it contains scattered pyrite crystals and fragments of arsenopyrite while, rarely, shells of pyrrhotite were noticed within pyrite.

A few tiny particles (diameter of the largest particle about 3μ) of a white mineral were observed in arsenopyrite. It is harder than the latter mineral and has a much higher reflectivity. Although no tests could be carried out on these grains it is likely that they consist of one or more of the platinum metals. The overseer at Eagle's Nest Mine states that on melting down the concentrates he has sometimes noticed a gray metallic substance which he thinks may be a platinoid.

III.—THE PYRITIC ORE

A. Fairview Mine

Fairview Mine is situated in the Sheba Hills about three miles east of Caledonian Siding. The samples from this mine consist of dark-coloured quartz-sericite rocks, altered quartzite, and carbonaceous shale, veined by quartz and carbonate (dolomite and ankerite), and in places brecciated. Weathered specimens composed of vein quartz, coarse-grained, massive pyrite, a little felspar and, rarely, greenish " chert " are present.

Laths of arsenopyrite (usually a few millimetres long) are present in carbonaceous shale and in altered quartzite, but are most plentiful in veinlets of " chert ". Small amounts of pyrite are associated with the arsenopyrite; the former mineral often forms lenticular or irregular, massive bodies up to a few centimetres thick. Veinlets of quartz cut these pyritic bodies.

The ore-microscope shows that many of the *arsenopyrite* crystals are broken and sheared. The *pyrite* associated with the arsenopyrite often shows ring-shaped and skeletal crystals and appears for the most part to be older than the latter mineral. This relationship may, however, be only apparent and a secondary effect of crushing and recrystallisation.

Die ertsminerale vorm onreëlmatige are en lense en sommige monsters lyk gestreep en geband. Die sulfiediese minerale wat voorkom is piriet, arseenpiriet, en pirrotiet met spore van chalkopiriet—die erts beklee dus 'n intermediêre posisie tussen die arseenpiriet—pirrotiettipe en die piriettipe. Piriet is die mineraal wat die volopste is. Arseenpiriet is nie volop nie, maar kom nogtans voor, terwyl pirrotiet 'n relatief minderwaardige rol speel.

Die piriet en arseenpiriet is geneig om in aparte bande en kolle voor te kom. Hulle kan betreklike massiewe liggame met min tussenkorrels van kwarts of dolomiet vorm, of hulle kan voorkom as afsonderlike kristalle wat taamlik eweredig deur die matriks van die aarsteen versprei is. Hier en daar word kristalle van arseenpiriet in groot pirietliggame aangetref, en eersgenoemde mineraal bevat gewoonlik baie klein geronde of onreëlmatige pirietkorrels. Al die minerale is erg gebreek en herkristalliseer. Volgens die waarnemings kan daar beskou word dat pirrotiet jonger as arseenpiriet is en dat piriet jonger as albei is, maar hierdie verhouding kan moontlik aan herkristallisasie en metamorfose toegeskryf word.

Pirrotiet kom voor as duidelik omlynde bande of as liggame van onreëlmatige vorm. Dit toon geen neiging om in die vorm van eievormige kristalle voor te kom nie. Deels bevat dit pirietkristalle en arseenpiriet-fragmente terwyl pirrotietdoppies by wyse van uitsondering binne piriet opgemerk is.

'n Paar baie klein deeltjies (diameter van die grootste kristal ongeveer 3μ) van 'n wit mineraal is in arseenpiriet opgemerk. Dit is harder as laasgenoemde mineraal en het 'n baie groter reflektiwiteit. Hoewel geen toetse op hierdie korrels uitgevoer kon word nie, is dit waarskynlik dat hulle uit een of meer van die platinummetale bestaan. Die opsigter by die Eagle's Nestmyn verklaar dat hy soms by die uitsmelt van die konsentrate 'n grys, metaalagtige stof opgemerk het wat hy meen 'n platinoïed kan wees.

III.—DIE PIRITIESE ERTS

A. Fairviewmyn

Fairviewmyn is in die Shebaheuwels ongeveer drie myl ten ooste van Caledoniansylyn geleë. Die monsters afkomstig van hierdie myn bestaan uit donkerkleurige kwarts-serisiet-gesteentes, veranderde kwartsiet, en koolstofhoudende skalie, met kwarts en karbonaat (dolomiet en ankeriet) geaar, en plek-plek gebreksieer. Verweerde monsters wat bestaan uit aarkwarts, grofkorrelrige massiewe piriet, 'n bietjie veldspaat, en, selde, groenagtige „ chert " kom voor.

Latte van arseenpiriet (gewoonlik 'n paar millimeter lank) is aanwesig in koolstofhoudende skalie en in veranderde kwartsiet, maar is die volopste in die „ chert "-aartjies. Klein hoeveelhede piriet is met die arseenpiriet geassosieer; eersgenoemde mineraal vorm dikwels lensagtige of onreëlmatige, massiewe liggame wat tot 'n paar centimeters dik is. Hierdie pirietliggame word deur kwartsaartjies gesny.

Die ertsmikroskoop toon dat baie van die kristalle van *arseenpiriet* gebreek of geskuifskeur is. Die *piriet* wat met die arseenpiriet geassosieer is, toon dikwels ringvormige en skeletkristalle, en skyn vir die grootste gedeelte ouer te wees as laasgenoemde mineraal. Hierdie verhouding mag egter bloot 'n skynbare wees en in werklikheid 'n sekondêre gevolg van vergruising en herkristallisasie.

The massive bodies of pyrite contain practically no other ore-minerals. Marginally arsenopyrite may occur, and very small amounts of *pyrrhotite* and *chalcopyrite* were noted.

Only two grains of *gold*, one about 20 microns in diameter, in pyrite and another about 4 microns, in arsenopyrite, were found.

B. Sheba Mine

The important Sheba Mine is situated near the railway siding of the same name and the following rock-types were obtained from this locality:—

(i) A green, chromiferous sericite schist.

(ii) A dark-coloured, slightly carbonaceous rock composed of sericite with some quartz and carbonate (ankerite).

(iii) A sericitic sandstone which resembles the previous type but contains more quartz.

These rocks are cut by veins and irregular bodies of quartz, both coarse-grained and cherty, and to a lesser extent by veins of ankerite. A few specimens consist practically exclusively of the quartzose material.

Most of the specimens examined contain only small amounts of sulphide which is represented chiefly by isolated crystals or irregular bodies of pyrite, a few tenths of a millimetre in diameter. Arsenopyrite occurs occasionally, mostly as veinlets, while visible gold was noted. A few veinlets of quartz, younger than the ore, were observed, as well as tourmaline in massive pyrite.

Under the ore-microscope it is seen that both *pyrite* and *arsenopyrite* only rarely show perfect crystal outlines. Whereas pyrite is always present in arsenopyrite-rich ore, arsenopyrite is not necessarily present in pyrite-rich ore. The pyrite appears in general to be older than the arsenopyrite and in a few cases it was noticed that this latter mineral forms pseudomorphs after pyrite. One specimen of massive pyritic ore contains much arsenopyrite as disseminated crystals about 0·05 millimetres in thickness.

Gold was observed in many polished sections. The coarse, visible gold is confined to arsenopyrite-bearing ore, but finer gold may occur in any mineral.

Small amounts of *chalcopyrite* are associated with the coarse gold; isolated grains of *chalcocite* and *covellite* are rarely present as alteration-products of chalcopyrite. The covellite and chalcocite occur separately as grains about 0·05 millimetres in diameter and some of these have cores of unaltered chalcopyrite. The covellite is granular in texture and extremely fine-grained.

A few small grains of *tetrahedrite* were also observed. The mineral is interstitial to pyrite and arsenopyrite and the largest fragments have a diameter of about 0·1 millimetres. The tetrahedrite has normal optical and physical properties and a small amount of the powder, drilled out, gave a strong test for antimony on examination by means of the spectrograph.

Die massiewe pirietliggame bevat feitlik geen ander ertsminerale nie. Langs die rande van die liggame kan arseenpiriet wel voorkom en baie klein hoeveelhede *pirrotiet* en *chalkopiriet* is opgemerk.

Slegs twee korrels *goud*, die een ongeveer 20 mikron in diameter, in piriet, en die ander ongeveer 4 mikron, in arseenpiriet, is gevind.

B. Shebamyn

Die belangrike Shebamyn is digby die spoorwegsylyn met dieselfde naam geleë en die volgende gesteentetipes is van hierdie plek af verkry:—

(i) 'n Groen, chroombevattende serisietskis.

(ii) 'n Donkerkleurige, effens koolstofbevattende gesteente wat bestaan uit serisiet en 'n hoeveelheid kwarts en karbonaat (ankeriet).

(iii) 'n Serisitiese sandsteen wat na die vorige tipe lyk maar meer kwarts bevat.

Hierdie gesteentes word deur are en onreëlmatige liggame van kwarts gesny wat sowel grofkorrelrig as chertagtig is, asook in 'n mindere mate deur are van ankeriet. 'n Paar monsters bestaan feitlik geheel en al uit die kwartsmateriaal.

Die meeste van die monsters wat ondersoek is, bevat slegs klein hoeveelhede sulfied wat in hoofsaak deur afgesonderde kristalle of onreëlmatige pirietliggame, 'n paar tiendes van 'n millimeter in diameter, verteenwoordig word. Arseenpiriet kom slegs hier en daar voor, meestal in die vorm van aartjies, terwyl sigbare goud opgemerk is. 'n Paar kwartsaartjies, jonger as die erts, asook toermalyn in massiewe piriet, is opgemerk.

Onder die ertsmikroskoop word gesien dat sowel *piriet* as *arseenpiriet* baie selde volmaakte kristalbuitelyne toon. Ofskoon piriet altyd in arseenpirietryk erts voorkom, is arseenpiriet nie noodwendig in pirietryk erts aanwesig nie. Dit kom voor of die piriet oor die algemeen ouer as die arseenpiriet is en in 'n paar gevalle is opgemerk dat laasgenoemde pseudomorfe na piriet vorm. Een monster van massiewe pirieterts bevat heelwat arseenpiriet in die vorm van verspreide kristalle, ongeveer 0·05 millimeter in dikte.

Goud is in baie gepoleerde ertsstukke opgemerk. Die growwe, sigbare goud is tot arseenpirietbevattende erts beperk, maar fyner goud kan in enige mineraal voorkom.

Geringe hoeveelhede *chalkopiriet* is met die growwe goud geassosieer, terwyl *chalkosiet* en *covelliet* by uitsondering as veranderingsprodukte van chalkopiriet voorkom. Die covelliet en chalkosiet kom afsonderlik voor in die vorm van korrels, ongeveer 0·05 millimeter in diameter, en sommige van hulle het kerns van onveranderde chalkopiriet. Die covelliet het korrelrige tekstuur en is besonder fynkorrelrig.

'n Paar klein korrels *tetraëdriet* is ook opgemerk. Die mineraal vorm tussenkorrels tussen piriet en arseenpiriet en die grootste brokke het 'n diameter van ongeveer 0·1 millimeter. Die tetraëdriet het normale optiese en fisiese eienskappe en 'n klein hoeveelheid uitgeboorde poeier het toe dit met die spektrograaf ondersoek is, sterk op die toets vir antimoon gereageer.

C. Golden Quarry Mine

The Golden Quarry Mine adjoins the Sheba Mine and the samples collected at this locality to some extent resemble those obtained from Sheba. A dark-coloured rock composed of chert, sericite, and small grains of quartz, probably an altered and silicified shaly sandstone, is well represented and usually contains in addition ferriferous dolomite and a little felspar (microcline and albite). Another rock-type encountered is gray and massive and consists of sericite with some quartz, while a rudely banded rock composed chiefly of chert and chlorite with pyrite and a little felspar is also present.

In the ore generally, sulphide is only sparingly present, mainly in the form of isolated grains of pyrite a few tenths of a millimetre in diameter. Occasionally these grains may coalesce into veinlets. Arsenopyrite was seen as minute needles which are concentrated along bands.

Pyrite is the common sulphide present. Under the ore-microscope, this mineral tends to form idiomorphic crystals, but in part the grains are completely irregular in shape. Deformed and broken crystals were also noticed. Most of the polished sections contain *arsenopyrite* as crystals which are usually fractured and deformed. Arsenopyrite may be older than the pyrite, but may rarely be pseudomorphous after pyrite. This suggests that there are two generations of arsenopyrite, an older generation which occurs as scattered needles, and a younger which was introduced together with chalcopyrite and coarse gold.

A small amount of *pyrrhotite* is present. A small grain (diameter about 40μ) of a fairly hard mineral occurs in contact with gold and chalcopyrite. It is tentatively identified as *corynite*.

A minute particle of presumed *silver* (diameter about 20μ) was also found. The grain was enclosed in pyrite and the reflectivity for red light was about the same as that of gold while that for green light was perceptibly higher. In order to test the possibility that a member of the platinum groups is present, gold-rich mine-concentrates were examined by means of the spectrograph. No platinum metal could be found.

In one sample containing visible gold, *galena* and very small amounts of *tetradymite* are associated with gold and chalcopyrite. As tetradymite is a rare mineral and the first telluride found in the Barberton District, its properties are given in some detail below and are compared with those of calaverite, which it resembles most closely, according to Schneiderhöhn and Ramdohr ([8]).

C. Golden Quarrymyn

Die Golden Quarrymyn grens aan die Shebamyn en die monsters wat hier versamel is, toon 'n mate van ooreenkoms met dié wat van Sheba verkry is. 'n Donkerkleurige gesteente wat bestaan uit chert, serisiet, en klein korrels kwarts, waarskynlik 'n veranderde en verkieselde skalieagtige sandsteen, is goed verteenwoordig en bevat daarbenewens gewoonlik ysterhoudende dolomiet en 'n bietjie veldspaat (mikroklien en albiet). 'n Ander gesteentetipe wat aangetref word, is grys en massief en bestaan uit serisiet met 'n hoeveelheid kwarts, terwyl 'n ru-gebande gesteente wat hoofsaaklik uit chert en chloriet met piriet en 'n bietjie veldspaat bestaan, ook aanwesig is.

Sulfied kom oor die algemeen min in die erts voor, en dan hoofsaaklik in die vorm van afgesonderde pirietkorrels, 'n paar tiendes van 'n millimeter in diameter. In enkele gevalle loop hierdie korrels ineen tot aartjies. Arseenpiriet is opgemerk in die vorm van baie klein naaldjies wat langs bande gekonsentreer is.

Piriet is die algemene sulfied wat daar voorkom. Onder die ertsmikroskoop toon hierdie mineraal die neiging om idiomorfiese kristalle te vorm, maar deels is hierdie korrels heeltemal onreëlmatig van vorm. Vervormde en gebreekte kristalle is ook opgemerk. Die meeste van die gepoleerde ertstukke bevat *arseenpiriet* in die vorm van kristalle wat gewoonlik gebreek en vervorm is. Arseenpiriet is moontlik ouer as die piriet, maar is by uitsondering pseudomorf na piriet. Dit laat die vermoede ontstaan dat daar twee generasies van arseenpiriet is, 'n ouer generasie wat in die vorm van verspreide naalde voorkom, en 'n jongere wat saam met chalkopiriet en growwe goud toegevoer is.

'n Klein hoeveelheid *pirrotiet* is aanwesig. 'n Klein korrel (diameter ongeveer 40μ) van 'n betreklik harde mineraal kom in kontak met goud en chalkopiriet voor. Dit is voorlopig as *koriniet* geïdentifiseer.

'n Baie klein deeltjie van wat vermoedelik *silwer* is, (diameter ongeveer 20μ) is ook aangetref. Die korrel was in piriet ingesluit en die reflektiwiteit vir rooi lig was naastenby dieselfde as dié van goud, terwyl dié vir groen lig aanmerklik hoër was. Ten einde die moontlikheid dat 'n lid van die platiniumgroepe aanwesig is, te toets, is goudryke mynkonsentrate met die spektrograaf getoets. Geen platinummetaal kon gevind word nie.

In een monster wat sigbare goud bevat is *galeniet* en baie klein hoeveelhede *tetradimiet* met goud en chalkopiriet geassosieer. Aangesien tetradimiet 'n baie seldsame mineraal is en die eerste telluried is wat in die Distrik Barberton gevind word, word sy eienskappe hieronder breedvoerig aangegee en vergelyk met dié van kalaveriet waarmee dit, volgens Schneiderhöhn en Ramdohr ([8]), die nouste ooreenkom.

TABLE NO. 1.—TETRADYMITE FROM GOLDEN QUARRY MINE

	Mineral from Golden Quarry Mine	Calaverite	Tetradymite
Composition.....	Spectrographic tests show presence of Bi and Te. Also Au, Ag, and Pb which may be derived from surrounding minerals	(Au,Ag) Te_2	Bi Te_2S
Reflectivity (in oil).	Red 36%, green 41%	Red 48·5%, green 54%	Red 38%, green 44%.
Colour.....	White with slight yellow cast compared with galena	White with brownish - yellow tinge	White with yellow tinge.
Hardness.....	Very slightly softer than galena	Like galena but a trace softer	H = $1\frac{1}{2}$ — 2 (Galena = $2\frac{1}{2}$).
Anisotropism.....	Apparently isotropic	Definite but comparatively weak	Weak but definite.
Etch-reactions.....	Pos. HNO_3, $FeCl_3$. Neg. HCl, KCN	HNO_3, pos.; $FeCl_3$, slight brown stain; HCl, KCN, neg.	HNO_3, pos.; $FeCl_3$, slight brown coating. HCl, KCN, neg.
Habit.....	Prisms or tabular crystals, about 0·15 × 0·04 millimetres	Not known	Thick tabular crystals or allotriomorphic aggregates.

D. ALPINE MINE

The Alpine Mine lies about four miles southwest of the Rosetta Mine on the slopes of the Moodies Hills.

The ore-bearer consists largely of carbonaceous sericite shale or slate and lighter-coloured quartz-dolomite rocks. Vein quartz, associated with traces of carbonate, has been observed and is more or less conformable to the bedding-planes.

Very little sulphide is visible in hand-specimens. Tiny scattered specks of pyrites, a few tenths of a millimetre in diameter, occur in the shale or quartzite, while small veins of this mineral, arranged parallel to the bedding-planes, are also present. In the vein quartz small specks of gold may be seen accompanied by chalcopyrite and rarely by gray tetrahedrite.

Under the ore-microscope, the *pyrite* shows a tendency to euhedralism, but perfect crystals are rare. Cracked and broken crystals may occur. Small amounts of *chalcopyrite* are associated with the pyrite, often occurring as veinlets in the latter mineral.

TABEL No. 1.—TETRADIMIET VAN GOLDEN QUARRYMYN

	Mineraal van Golden Quarrymyn	Kalaveriet	Tetradimiet
Samestelling.....	Spektrografiese toetse toon die aanwesigheid van Bi en Te. Ook Au, Ag, en Pb wat van omliggende minerale afkomstig mag wees	(Au, Ag)Te_2	$BiTe_2S$
Reflektiwiteit (in olie)	Rooi 36%, groen 41%	Rooi 48·5%, groen 54%	Rooi 38%, groen 44%.
Kleur.....	Wit met 'n effense neiging tot geel vergeleke met galeniet	Wit met 'n effense bruingelerigheid	Wit met 'n effense gelerigheid.
Hardheid.....	Effens sagter as galeniet	Soos galeniet maar effens sagter	H = 1½ — 2 (galeniet = 2½).
Anisotropisme.....	Blykbaar isotroop	Beslis, maar betreklik swak	Swak, maar beslis.
Etsreaksies.....	Pos. HNO_3, $FeCl_3$. Neg. HCl, KCN	HNO_3, pos.; $FeCl_3$ effens bruingekleur; HCl, KCN, neg.	HNO_3, pos.; $FeCl_3$, effense bruin bestryking; HCl, KCN, neg.
Habitus.....	Prismas of tafelvormige kristalle, ongeveer 0·15 × 0·04 millimeter	Onbekend	Dik, tafelagtige kristalle of allotriomorfe aggregate.

D. ALPINEMYN

Die Alpinemyn lê ongeveer vier myl suidwes van die Rosettamyn teen die hange van die Moodiesheuwels.

Die ertsdraer bestaan hoofsaaklik uit koolstofhoudende serisietskalie of -lei en ligkleuriger kwartsdolomietgesteentes. Aarkwarts wat met spore van karbonaat geassosieer is, is opgemerk en is min of meer konkordant met die laagvlakke.

Baie min sulfied is in handmonsters sigbaar. Klein verspreide spikkels piriet, 'n paar tiendes van 'n millimeter in diameter, kom in die skalie of kwartsiet voor, terwyl klein aartjies van hierdie mineraal wat parallel met die laagvlakke gerangskik is, ook voorkom. In die aarkwarts kan klein spikkels goud gesien word wat vergesel gaan van chalkopiriet en hier en daar van grys tetraëdriet.

Onder die ertsmikroskoop toon die *piriet* 'n neiging tot eievormigheid, maar volmaakte kristalle is seldsaam. Gebarste of gebreekte kristalle kom wel voor. Klein hoeveelhede *chalkopiriet* is met die piriet geassosieer en kom dikwels as aartjies in laasgenoemde mineraal voor.

The boundaries between vein quartz and wall-rock are sharp, and the veins are often bordered by stringers of pyrite. The vein quartz contains reticulated masses of sulphide and coarse gold. The following sulphide minerals have been observed: *pyrite*, *chalcopyrite*, *tetrahedrite*, *galena*, *sphalerite*, and *violarite*. Finally, one small grain of presumed *corynite* was seen under the ore-microscope.

No gold was found in the pyrite occurring in the shale or in the quartzite. This pyrite is probably older than the sulphide associated with the vein quartz.

E. Agnes Mine

The Agnes Mine lies high up in the Moodies Hills about one and a half miles east of the Alpine Mine and the ore-bearer from this property resembles that from the Alpine. It is a greenish-gray, partially silicified slate composed of chromiferous sericite, quartz, potash felspar, and dolomite. Small unoriented veins of quartz and of " chert " occur. The quartz is often associated with dolomite while fine-grained potash felspar and dolomite are present in the chert veins. A thin section of the " chert " shows that the minerals are sheared and brecciated (pl. II).

Pyrite is the only visible sulphide. It is present as scattered grains a few tenths of a millimetre in diameter or as clusters of grains. As in the Alpine, the visible gold in the Agnes Mine is present in the quartz veins.

Under the ore-microscope most of the *pyrite* crystals are seen to be irregular in shape. In the altered slate, traces of *chalcopyrite* occur within the pyrite, while in the veins the pyrite is associated with chalcopyrite, coarse *gold* and small amounts of *sphalerite*. Several particles of gold (1μ — 20μ in diameter) were found associated with pyrite in what may be altered slate. In this respect the ore from Agnes would thus differ from the ore from the Alpine Mine, where the gold occurs solely in the quartz veins.

F. Three Sisters Mine

The Three Sisters Mine lies about six miles east of Louw's Creek Siding. The country-rock here is a banded schist which is composed of sericite, ferriferous dolomite, and fine-grained quartz, the last-named two minerals being usually intimately associated and forming closely spaced bands, several millimetres thick, in the sericite. The bands may exhibit small folds and the carbonate and quartz may cut through the sericite layers. In samples of vein quartz, pyrite and one or more of the following minerals, viz. tourmaline, sericite, dolomite, and chlorite, are present.

Spectrographic tests showed that the sericite schist contains small amounts of vanadium. A sample was submitted to the Division of Chemical Services for the quantitative determination of this metal and the following result was returned:—

$V_2O_5 = 0{\cdot}054$ per cent (Analyst: Mr. C. J. Liebenberg).

Iron pyrites, the only sulphide visible, is relatively abundant in the ore. In the banded samples, small grains, a few tenths of a millimetre in diameter, are concentrated in thin layers. In the more massive ore, the grains which may be a few millimetres in diameter form ill-defined stringers or patches of irregular shape. Visible gold was observed as clouds of dust-like particles in vein quartz.

Die grense tussen aarkwarts en wandgesteente is skerp en daar is dikwels pirietaartjies langs die rande. Die aarkwarts bevat netvormige massas sulfied en growwe goud. Die volgende sulfiedminerale is waargeneem: *piriet*, *chalkopiriet*, *tetraëdriet*, *galeniet*, *sfaleriet*, en *violariet*. Laastens is een klein korrel van wat vermoedelik *koriniet* is, onder die ertsmikroskoop gesien.

Geen goud is in die piriet gevind wat in die skalie of in die kwartsiet voorkom nie. Hierdie piriet is waarskynlik ouer as die sulfied wat met die aarkwarts geassosieer is.

E. Agnesmyn

Die Agnesmyn is hoog op in die Moodiesheuwels en ongeveer een-en-'n-halfmyl oos van die Alpinemyn geleë en die ertsdraer op hierdie eiendom lyk na die van die Alpine. Dit is 'n groengrys, gedeeltelik verkieselde lei wat bestaan uit chroombevattende serisiet, kwarts, kaliveldspaat, en dolomiet. Klein ongeoriënteerde are van kwarts en „ chert " kom voor. Die kwarts is in baie gevalle met dolomiet geassosieer, terwyl fynkorrelrige kaliveldspaat en dolomiet in die chertare voorkom. 'n Slypplaatjie van die „ chert " toon dat die minerale geskuifskeur en gebreksieer is (pl. II).

Piriet is die enigste sigbare sulfied. Dit is aanwesig as verspreide korrels, 'n paar tiendes van 'n millimeter in diameter, of as groepies korrels. Net soos by Alpine, kom die sigbare goud by die Agnesmyn in die kwartsare voor.

Onder die ertsmikroskoop kan gesien word dat die meeste *piriet*kristalle onreëlmatig van vorm is. In die veranderde lei kom spore van *chalkopiriet* in die piriet voor, terwyl die piriet in die are met chalkopiriet, growwe *goud* en klein hoeveelhede *sfaleriet* geassosieer is. Verskeie deeltjies goud (1μ — 20μ in diameter) is gevind wat met piriet geassosieer is in wat veranderde lei kan wees. In hierdie opsig verskil die erts van Agnes dus van dié van die Alpinemyn waar die goud uitsluitlik in die kwartsare voorkom.

F. Three Sistersmyn

Die Three Sistersmyn is sowat ses myl ten ooste van Louw's Creeksylyn geleë. Die newegesteente hier is 'n gebande skis wat bestaan uit serisiet, ysterbevattende dolomiet, en fynkorrelrige kwarts. Laasgenoemde twee minerale is gewoonlik baie nou met mekaar geassosieer en vorm digopeen-volgende bande, verskeie millimeter dik, in die serisiet. Die bande vertoon hier en daar klein plooie en die karbonaat en kwarts sny plek-plek deur die serisietlae. In monsters van aarkwarts is piriet en een of meer van die minerale toermalyn, serisiet, dolomiet, en chloriet aanwesig.

Spektrografiese toetse het getoon dat die serisietskis klein hoeveelhede vanadium bevat. 'n Monster is na die Afdeling Skeikundige Diens gestuur vir die kwantitatiewe bepaling van hierdie metaal en die volgende resultaat is verkry:—

V_2O_5 = 0·054 persent (Analis: Mnr. C. J. Liebenberg.)

Ysterpiriet, die enigste sulfied sigbaar, is betreklik volop in die erts. In die gebande monsters is klein korrels, 'n paar tiendes van 'n millimeter in diameter, in dun lae gekonsentreer. In die massiewer erts vorm die korrels wat 'n paar millimeter in diameter kan wees, swakomlynde aartjies of kolle wat onreëlmatig van vorm is. Sigbare goud is in die vorm van wolkies van stofagtige deeltjies in die aarkwarts opgemerk.

Under the ore-microscope it is seen that the *pyrite* crystals are to a considerable extent sheared and corroded. The effects of this deformation is also demonstrated by broken needles of tourmaline which lie in a matrix of carbonate. Very small amounts of *chalcopyrite* are associated with the pyrite.

Gold, 1–20 microns in diameter, was often observed and is not confined to the quartz or carbonate veins. The gold is mainly associated with pyrite but has also been observed in the gangue. Isolated small grains of tetrahedrite occur in association with gold and chalcopyrite.

G. Barbrook Mine

The Barbrook Mine lies about six miles south of Louw's Creek Siding. It is not worked at present and samples of considerably weathered ore-bearer only could be obtained from the Sofala section of this property. Most of these consist of vein quartz with fairly coarse-grained pyrite (average diameter of individual grains, a few millimetres), ferriferous dolomite, small masses of attached carbonaceous shale, and soft iron oxides. The grains of pyrite usually form clusters of irregular shape or veinlets and in addition to this mineral, crystals of weathered arsenopyrite are sparingly present.

Under the ore-microscope it is seen that much *pyrite* is bounded by crystal-faces. *Arsenopyrite* is not intimately associated with pyrite but occurs as separate clusters of crystals (average diameter of individual crystals, a few tenths of a millimetre). Most of the grains are corroded and broken and in some cases they have been finely crushed.

Small amounts of *pyrrhotite* occur as irregular grains, a few tenths of a millimetre in diameter. *Melnikovite-pyrite* is rarely present, probably as an alteration-product. Traces of *chalcopyrite* were found. One minute grain, about 8 microns in diameter, of a white mineral was tentatively identified as metallic *bismuth*.

Particles of *gold* which vary in size from a few microns to about 60 microns were observed. They are usually associated with arsenopyrite.

H. Belfast Mine

The samples obtained from this property which lies about four miles north of Barberton, consist of massive quartzite with a little greenish sericite. Sulphide is relatively scarce and only a few grains of pyrite and chalcopyrite, a few tenths of a millimetre in diameter, were observed.

Under the ore-microscope it is seen that *pyrrhotite*, *chalcopyrite*, and *pyrite* are major sulphidic constituents of the ore. The first two minerals form veinlets and bodies of irregular shape and the last is present as fairly well-formed crystals.

Large grains of gold were found in mine-concentrates.

I. Woodstock Mine

Two types of rock occur in this mine which is situated near Noordkaap Siding. The first is a talc schist with bands of ferriferous dolomite and grains of pyrite (a few tenths of a millimetre to a few millimetres in diameter) arranged along layers. The second is a foliated sericite-chert rock. Veinlets composed of quartz and dolomite traverse this rock and grains of pyrite are scattered through the specimens.

Onder die ertsmikroskoop kan gesien word dat die *piriet*kristalle aanmerklik geskuifskeur en gekorrodeer is. Die uitwerking van hierdie deformasie blyk ook uit die gebreekte naalde van toermalyn wat in die matriks van karbonaat lê. Baie klein hoeveelhede *chalkopiriet* is met die piriet geassosieer.

Goud, 1–20 mikron in diameter, is dikwels opgemerk en is nie tot die kwarts of karbonaatare beperk nie. Die goud is hoofsaaklik met piriet geassosieer maar is ook in die aarsteen opgemerk. Afgesonderde klein korrels tetraëdriet kom met goud en chalkopiriet geassosieer, voor.

G. Barbrookmyn

Die Barbrookmyn is sowat ses myl suid van Louw's Creeksylyn geleë. Dit word nie op die oomblik ontgin nie en monsters van aansienlik verweerde ertsdraer kon slegs van die Sofala-afdeling van hierdie eiendom verkry word. Die meeste hiervan bestaan uit aarkwarts met taamlik grofkorrelrige piriet (gemiddelde diameter van indiwiduele korrels, 'n paar millimeter), ysterbevattende dolomiet, klein massas aangehegte koolstofskalie, en sagte ysteroksiede. Die pirietkorrels vorm gewoonlik trossies van onreëlmatige vorm, of aartjies, en benewens hierdie mineraal kom kristalle van verweerde arseenpiriet yl voor.

Onder die ertsmikroskoop kan gesien word dat baie *piriet* deur kristalvlakke begrens word. *Arseenpiriet* is nie nóú met piriet geassosieer nie, maar kom voor as afsonderlike trossies kristalle (gemiddelde diameter van indiwiduele kristalle, 'n paar tiendes van 'n millimeter). Die meeste van die korrels is gekorrodeer en gebreek en in sommige gevalle is hulle fyn vergruis.

Klein hoeveelhede *pirrotiet* kom voor as onreëlmatige korrels, 'n paar tiendes van 'n millimeter in diameter. *Melnikoviet-piriet* is selde aanwesig en kom waarskynlik as 'n veranderingsproduk voor. Spore van *chalkopiriet* is gevind. Een klein korreltjie, ongeveer 8 mikron in diameter, van 'n wit mineraal is voorlopig as gedeë *bismut* geïdentifiseer.

Deeltjies *goud* wat in grootte varieer van 'n paar mikron tot ongeveer 60 mikron, is opgemerk. Hulle is gewoonlik met arseenpiriet geassosieer.

H. Belfastmyn

Die monsters verkry van hierdie eiendom wat ongeveer vier myl benoorde Barberton lê, bestaan uit massiewe kwartsiet met 'n bietjie groenerige serisiet. Sulfied is betreklik skaars en slegs 'n paar korrels piriet en chalkopiriet, 'n paar tiendes van 'n millimeter in diameter, is opgemerk.

Onder die ertsmikroskoop kan gesien word dat *pirrotiet*, *chalkopiriet*, en *piriet* die vernaamste sulfidiese bestanddele van die erts is. Eersgenoemde twee minerale vorm aartjies en liggame van onreëlmatige vorm en laasgenoemde kom voor as taamlik goed gevormde kristalle.

Groot korrels goud is in mynkonsentrate aangetref.

I. Woodstockmyn

In hierdie myn wat naby Noordkaapsylyn geleë is, kom twee tipes gesteentes voor. Die eerste is 'n talkskis met bande ysterhoudende dolomiet en korrels piriet ('n paar tiendes van 'n millimeter tot 'n paar millimeter in diameter) wat langs lae gerangskik is. Die tweede is 'n gefolieerde serisiet-chertgesteente.

Under the ore-microscope most of the *pyrite* proved to be euhedral to subhedral, but some of the grains have jagged outlines and show the effects of corrosion. *Pyrrhotite* and *chalcopyrite* are present as inclusions in many pyrite crystals (in both types of rock) and these two minerals also occur as clusters of small grains (10–50μ in diameter) in the talc schist.

Small amounts of *arsenopyrite* were found in the sericite-chert rock. The arsenopyrite does not form the usual neddle- and diamond-shaped crystals, but occurs as small grains of irregular shape associated with pyrite and as inclusions in this mineral.

J. Clutha Mine

The Clutha Mine is situated about one and a half miles northeast of the railway siding of the same name. The ore-bearer was examined from two sections of the property, viz. Clutha and " Clutha, lower mine ". That from the former section is quartzite belonging to the Moodies System and that from the latter is altered lava of the Fig-tree Series.

The quartzite of Clutha is felspathic with streaks of shaly material. Glassy quartz, chert, and thin veins of dolomite occur sparingly. Very small amounts of pyrite were seen, the mineral being present as disseminated grains a few tenths of a millimetre in diameter, or as small clusters of grains.

The ore from " Clutha, lower mine ", is fine-grained and massive. It consists of sericite, some felspar (albite), chlorite, quartz, and dolomite. Very small amounts of arsenopyrite and pyrite are present, the former mineral occurring as minute crystals, barely discernible with the naked eye, and the latter as scattered grains (a few tenths of a millimetre in diameter), clusters of crystals, and veinlets.

Under the ore-microscope it is seen that, in addition to *pyrite*, *chalcopyrite* and *pyrrhotite* are present in the Clutha ore. The last two sulphides occur as small grains, usually a few hundredths of a millimetre in diameter, in quartz and sericite. A few inclusions of these minerals have also been observed in pyrite. Several grains of *gold*, 5 microns to 50 microns in diameter, are present in pyrite.

In the ore from " Clutha, lower mine," most of the grains of *pyrite* are highly irregular in shape and only rarely were crystal-outlines seen. The arsenopyrite, on the other hand, is present as idiomorphic needles (a few hundredths to a few tenths of a millimetre in thickness) some of which are fractured and deformed. Where the two minerals are in contact, the pyrite is usually moulded on to idiomorphic crystals of arsenopyrite. Traces of *chalcopyrite* and *pyrrhotite* occur as inclusions in pyrite and, finally, a number of grains of *gold* (4μ — 30μ in diameter) were observed in pyrite.

K. Pigg's Peak Mine

The Pigg's Peak Mine lies in Swaziland about sixteen miles southeast of Barberton and ore-bearer composed of fine-grained quartz with a little pyrite and weathering-products was obtained from this property. The pyrite is present as small grains, a few tenths of a millimetre in diameter, which are

Aartjies wat bestaan uit kwarts en dolomiet deurkruis hierdie gesteente en korrels piriet is deur die monsters versprei.

Onder die ertsmikroskoop het geblyk dat die grootste deel van die *piriet* eievormig tot halfeievormig is, maar sommige korrels het getande buitelyne en toon die uitwerking van korrosie. *Pirrotiet* en *chalkopiriet* kom voor as insluitsels in baie pirietkristalle (in beide tipes gesteentes) en hierdie twee minerale kom ook voor as trossies klein korrels (10 — 50μ in diameter) in die talkskis.

Klein hoeveelhede *arseenpiriet* is in die serisietchertgesteente aangetref. Die arseenpiriet vorm nie die gewone naald- en diamantvormige kristalle nie, maar kom voor as klein korrels van onreëlmatige vorm wat met piriet geassosieer is, en ook as insluitsels in hierdie mineraal.

J. Cluthamyn

Die Cluthamyn is sowat een-en-'n-halfmyl noordoos van die spoorwegsylyn met dieselfde naam geleë. Die ertsdraer van twee afdelings van hierdie eiendom, nl. Clutha en „ Clutha, lower mine ", is ondersoek. Dié van eersgenoemde afdeling is kwartsiet wat tot die Sisteem Moodie behoort en dié van laasgenoemde is veranderde lawa van die Serie Fig-tree.

Die kwartsiet van Clutha is veldspaties met strepe van skalieagtige materiaal. Glasagtige kwarts, chert en dun are dolomiet kom slegs hier en daar voor. Baie min piriet is opgemerk. Die mineraal kom voor as gedissemineerde korrels, 'n paar tiendes van 'n millimeter in diameter, of as klein trossies korrels.

Die erts van „ Clutha, lower mine " is fynkorrelrig en massief. Dit bestaan uit serisiet, 'n bietjie veldspaat (albiet), chloriet, kwarts en dolomiet. Baie min arseenpiriet en piriet kom voor, eersgenoemde as nietigklein kristalle wat skaars met die blote oog sigbaar is, en laasgenoemde as verspreide korrels ('n paar tiendes van 'n millimeter in diameter), trossies kristalle, en aartjies.

Onder die ertsmikroskoop kan gesien word dat benewens *piriet* ook *chalkopiriet* en *pirrotiet* in die Clutha-erts voorkom. Laasgenoemde twee sulfiede kom in kwarts en serisiet voor in die vorm van klein korrels, gewoonlik 'n paar honderdstes van 'n millimeter in diameter. 'n Paar insluitsels van hierdie minerale is ook in piriet opgemerk. Verskeie korrels *goud*, 5 tot 50 mikron in diameter, is in piriet aanwesig.

In die erts van „ Clutha, lower mine " is die meeste van die korrels *piriet* baie onreëlmatig van vorm en is kristalbuitelyne slegs selde opgemerk. Die arseenpiriet kom daarenteë voor as idiomorfe naalde ('n paar honderdstes tot 'n paar tiendes van 'n millimeter dik) waarvan sommige gebreek en vervorm is. Waar die twee minerale met mekaar in kontak is, is die piriet gewoonlik op idiomorfe kristalle arseenpiriet gevorm. Spore van *chalkopiriet* en *pirrotiet* kom voor as insluitsels in piriet en ten slotte is 'n aantal korrels *goud* (4μ tot 30μ in diameter) in piriet opgemerk.

K. Pigg's Peakmyn

Die Pigg's Peakmyn lê in Swasiland ongeveer sestien myl suidoos van Barberton en ertsdraer wat saamgestel is uit fynkorrelrige kwarts met 'n bietjie piriet en verweringsprodukte is vanaf hierdie eiendom verkry. Die piriet kom voor as klein korrels, 'n paar tiendes van 'n millimeter in diameter,

either disseminated through the ore or form clusters. It also occurs as reticulated masses and veinlets a few millimetres thick. A few tiny needles of arsenopyrite were observed. The petrographic microscope revealed the presence of small amounts of tourmaline.

Under the ore-microscope most of the bodies of *pyrite* are seen to be quite irregular in shape. Many of the *arsenopyrite* needles are deformed and broken and skeletal forms were also observed. These crystals occur both in the quartz and in the pyrite.

Small amounts of *pyrrhotite* and *chalcopyrite* are present. The grains have an average diameter of about one tenth of a millimetre, are irregular in shape, and are mostly enclosed in quartz, but have also been observed in pyrite. *Melnikovite-pyrite* is sometimes present as an alteration-product. The ore-minerals have undoubtedly to a greater or lesser extent been altered in the zone of oxidation. It is thus likely that the composition of these specimens differs appreciably from that of the fresh ore.

A few grains of *cobaltite* were found, the largest crystal (which was enclosed in quartz) being about one tenth of a millimetre long and rhombic in shape. Another grain had the shape of an imperfect rod and occurred in pyrite. The cobaltite had normal properties with reflectivity (in oil), green 40·1 per cent, red 39·5 per cent. Quite strong cobalt lines were obtained with the spectrograph on arcing an ore-sample.

A few grains of *gold*, the largest of which measures ten microns by thirty microns, were found close to crystals of arsenopyrite. The gold was enclosed in quartz, but one minute particle, about two microns in diameter, was observed in pyrite.

L. Sheba Queen Mine

The old Sheba Queen Mine lies in the valley of the Komati River about 18 miles south of Barberton. It is not worked at present. The ore-bearer is highly pyritic and mainly of two types. The first is composed of fine-grained quartz with varying amounts of pyrite, and the second of carbonate (ankerite and siderite) and pyrite. The pyrite in both rock-types is fairly fine-grained. The crystals are usually crowded together in clusters of irregular shape, but may also be disseminated throughout the ore. A few samples are composed practically entirely of massive pyrite with only small amounts of interstitial quartz or carbonate and in one case a network of small veinlets of " chert " was observed in the pyrite. " Chert " and fine-grained chlorite may occur among the disseminated grains of pyrite. Small amounts of tourmaline were found.

Under the ore-microscope it becomes evident that *pyrite* is the main sulphidic mineral. It occurs both as bodies of irregular shape and as fairly well-formed crystals. Broken and partially recrystallised grains as well as skeletal forms have also been observed.

Small amounts of *arsenopyrite* are present. With the exception of a few idiomorphic needles, this mineral occurs as anhedral grains in intimate association with pyrite, which it appears to replace.

Traces of *pyrrhotite* and *chalcopyrite* are present as inclusions in pyrite; two grains of *gold*, 7 and 12 microns in diameter, were found in carbonate

wat òf deur die erts gedissemineer is, òf trossies vorm. Dit kom ook voor as netvormige massas en aartjies, 'n paar millimeter dik. 'n Paar klein naaldjies arseenpiriet is opgemerk. Die petrografiese mikroskoop het die aanwesigheid van klein hoeveelhede toermalyn openbaar.

Onder die ertsmikroskoop kan gesien word dat die *piriet*liggame heeltemal onreëlmatig van vorm is. Baie *arseenpiriet*naalde is vervorm en gebreek en skeletvorme is ook opgemerk. Hierdie kristalle kom in sowel die kwarts as die piriet voor.

Klein hoeveelhede *pirrotiet* en *chalkopiriet* is aanwesig. Die korrels het 'n gemiddelde diameter van ongeveer een-tiende van 'n millimeter, is onreëlmatig van vorm, en is meestal in kwarts omsluit, maar is ook in piriet opgemerk. *Melnikoviet-piriet* kom soms as 'n veranderingsproduk voor.

Die ertsminerale is ongetwyfeld in 'n mindere of meerdere mate in die oksidasiesone verander. Dit is dus waarskynlik dat die samestelling van hierdie monsters aanmerklik van dié van die vars erts verskil.

'n Paar korrels *kobaltiet* is gevind waarvan die grootste kristal (in kwarts omsluit) ongeveer een-tiende van 'n millimeter lank en rombies van vorm is. 'n Ander korrel het die vorm van 'n onvolmaakte stafie gehad en het in piriet voorgekom. Die kobaltiet het normale eienskappe getoon met reflektiwiteit (in olie), groen 40·1 persent, rooi 39·5 persent. Met die vergloeiing van 'n ertsmonster in die spektrograaf is taamlike sterk kobaltlyne verkry.

'n Paar korrels *goud* waarvan die grootte van die grootste tien by dertig mikron was, is digby kristalle arseenpiriet gevind. Die goud was in kwarts omsluit, maar een baie klein deeltjie, ongeveer twee mikron in diameter, is in piriet opgemerk.

L. Sheba Queenmyn

Die ou Sheba Queenmyn lê in die vallei van die Komatirivier, sowat 18 myl suid van Barberton. Dit word nie op die oomblik ontgin nie. Die ertsaar is sterk pirities, en bestaan hoofsaaklik uit twee tipes. Die eerste bestaan uit fynkorrelrige kwarts met variërende hoeveelhede piriet, en die tweede uit karbonaat (ankeriet en sideriet) en piriet. Die piriet in beide gesteentetipes is taamlik fynkorrelrig. Die kristalle is gewoonlik in groepies van onreëlmatige vorm saamgebondel, maar kan ook dwarsdeur die erts gedissemineer wees. 'n Paar monsters bestaan feitlik geheel en al uit massiewe piriet met slegs klein hoeveelhede tussenkwarts of -karbonaat en in een geval is 'n netwerk „ chert "-aartjies in die piriet opgemerk. „ Chert " en fynkorrelrige chloriet kom soms tussen die gedissemineerde korrels piriet voor. Klein hoeveelhede toermalyn is aangetref.

Onder die ertsmikroskoop blyk duidelik dat *piriet* die hoofsulfiedmineraal is. Dit kom voor as liggame van onreëlmatige vorm asook van taamlik goed gevormde kristalle. Gebreekte en gedeeltelik herkristalliseerde korrels sowel as skeletvorms, is ook opgemerk.

Klein hoeveelhede *arseenpiriet* is aanwesig. Met uitsondering van 'n paar idiomorfe naalde, kom hierdie mineraal as oneievormige korrels voor in noue assosiasie met piriet, wat dit moontlik vervang.

Spore van *pirrotiet* en *chalkopiriet* is aanwesig as insluitsels in piriet; twee korrels *goud*, 7 en 12 mikron in diameter, is in karbonaat gevind.

M. Comstock Mine

The Comstock Mine lies about three miles south of the old workings of Sheba Queen Mine and most of the ore-bearer consists of vein quartz in an altered schistose rock. Partings and small indistinct seams of chlorite traverse the rock whilst carbonates (calcite and ferriferous dolomite) are also present. Pyrite occurs sparingly as grains of variable size (diameter about 0·1 mm. to 1 mm.). These may be disseminated, or concentrated in streaks, mostly in the chlorite partings. Clusters of minute, barely visible needles of arsenopyrite were observed in one instance.

Under the ore-microscope it is seen that most of the *pyrite* crystals are fairly well formed but some appear to have been crushed. The *arsenopyrite* displays its usual tendency to form euhedral needles. Most of the crystals are, however, cracked and, as with the pyrite, are intensely brecciated. *Chalcopyrite* occurs as allotriomorphic particles (up to about one tenth of a millimetre in diameter) mostly in carbonate. Traces of this mineral as well as of *pyrrhotite* are also present in the pyrite.

Particles of *gold* were found in two polished sections. In one, several grains (the largest a narrow rod, 30μ in length) occur in pyrite; in the other, one grain about five microns in diameter was found in pyrite and a minute particle, about two microns in diameter, in arsenopyrite.

N. Forbes Reef

The Forbes Reef group of mines is situated in Swaziland about seventeen miles southwest of Pigg's Peak Mine and none of them was working at the time of the investigation. Specimens of mottled and in part foliated rocks were obtained from the westerly workings on the slopes of the Ingwenya Hills. These consist of talc, chlorite, carbonate (ferriferous magnesite and ankerite), a little albite, and traces of tourmaline. Irregular bodies and veins of quartz are present.

Sulphide is relatively scarce and is represented chiefly by disseminated grains of *pyrite* (a few tenths of a millimetre to a few millimetres in diameter) in the carbonate. These grains may locally coalesce to form stringers of clusters. Small veinlets of *chalcopyrite* were also observed. The latter mineral occurs in veinlets of quartz which traverse the specimens and also as small allotriomorphic grains (a few hundredths of a millimetre in diameter) and veinlets in pyrite.

A few grains of *gold*, six microns to twenty microns in diameter, were observed in pyrite.

IV.—THE LEAD-BEARING ORE

A. Rosetta Mine

The Rosetta Mine lies about four miles southwest of Barberton. At the time of the writer's visit (July, 1948), it was still being worked, but it has since been closed down. Most of the samples obtained from this property consist of vein quartz which varies in colour from white to dark-gray. The ore-minerals form rude veins or bodies of irregular shape in the quartz. Small amounts of coarse-grained ferriferous dolomite are associated with the ore-minerals. The wall-rock is a gray, shaly or slaty rock, usually composed of sericite and fine-grained quartz, and sometimes contains considerable amounts of fine-grained carbonate (ferriferous dolomite).

M. Comstockmyn

Die Comstockmyn lê ongeveer drie myl suid van die ou werkplekke van Sheba Queenmyn en die ertsdraer bestaan vir die grootste gedeelte uit 'n veranderde skisagtige gesteente. Skeidings en klein onduidelike are chloriet deurkruis die gesteente, terwyl karbonate (kalsiet en ysterhoudende dolomiet) ook aanwesig is. Piriet is skaars en kom voor as korrels wat varieer in grootte (diameter ongeveer 0·1 mm. tot 1 mm.). Dié kom òf gedissemineer òf in strepe gekonsentreer voor, meestal in die chlorietskeidings. Groepies nietigklein, skaars sigbare naalde arseenpiriet is in een geval opgemerk.

Onder die ertsmikroskoop kan gesien word dat die meeste van die kristalle *piriet* taamlik goed ontwikkel is, maar dit lyk of sommige vergruis is. Die *arseenpiriet* openbaar sy gewone neiging om eievormige naalde te vorm. Die meeste van die kristalle is egter gekraak en is, net soos die piriet, erg gebreksieer. *Chalkopiriet* kom merendeels in karbonaat voor in die vorm van allotriomorfe deeltjies (tot een-tiende van 'n millimeter is diameter). Spore van hierdie mineraal, asook van *pirrotiet*, kom ook in die piriet voor.

Deeltjies *goud* is in twee gepoleerde ertsstukke gevind. In een kom verskeie korrels (die grootste 'n smal stafie, 30μ lank) in piriet voor, en in die ander is een korrel aangetref, ongeveer vyf mikron in diameter, in piriet, en 'n baie klein deeltjie, ongeveer twee mikron in diameter, in arseenpiriet.

N. Forbes Reefmyne

Die myngroep, Forbes Reef, is in Swasieland geleë, ongeveer sewentien myl suidwes van Pigg's Peakmyn, en ten tyde van die ondersoek was nie een van hulle in bedryf nie. Monsters van gevlekte en gedeeltelik gefolieerde gesteentes is van die westelike werkplekke aan die hange van die Ingwenya-heuwels verkry. Hulle bestaan uit talk, chloriet, karbonaat (ysterbevattende magnesiet en ankeriet), 'n bietjie albiet, en spore van toermalyn. Onreëlmatige liggame en are kwarts kom ook voor.

Sulfied is betreklik skaars en word hoofsaaklik verteenwoordig deur korrels *piriet* ('n paar tiendes van 'n millimeter tot 'n paar millimeter in diameter) in die karbonaat. Hierdie korrels smelt in sekere gevalle plaaslik saam en vorm dan aartjies of trossies. Klein aartjies van *chalkopiriet* is ook opgemerk. Laasgenoemde mineraal kom in kwartsaartjies voor wat die monsters deurkruis, en ook as klein allotriomorfe korrels ('n paar honderdstes van 'n millimeter in diameter) en aartjies in piriet.

'n Paar korrels *goud*, ses tot twintig mikron in diameter, is in piriet opgemerk.

IV.—DIE LOODBEVATTENDE ERTS

A. Rosettamyn

Die Rosettamyn lê ongeveer vier myl suidwes van Barberton. Ten tyde van die skrywer se besoek (Julie 1948) is dit nog ontgin, maar is sedertdien gesluit. Die meeste monsters wat van hierdie eiendom verkry is, bestaan uit aarkwarts wat in kleur varieer van wit tot donkergrys. Die ertsminerale vorm ruwe are of onreëlmatiggevormde liggame in die kwarts. Klein hoeveelhede grofkorrelrige ysterbevattende dolomiet is met die ertsminerale geassosieer. Die wandgesteente is 'n grys, skalieagtige of leiagtige gesteente wat gewoonlik uit serisiet en fynkorrelrige kwarts bestaan en soms aansienlike hoeveelhede fynkorrelrige karbonaat (ysterhoudende dolomiet) bevat.

According to Strauss*, the white and the darker-coloured quartz form two separate reefs in a plunging syncline. They are known as the " white reef " and the " blue reef " respectively.

The ore-minerals visible in hand-specimens are the following: galena, sphalerite, pyrite, chalcopyrite, and tetrahedrite; the last two minerals are much less abundant than the other three. The grain-size is variable with a maximum diameter of a few millimetres. Galena and sphalerite usually occur together while pyrite is often found alone. The dark-coloured quartz contains composite bands consisting of sphalerite and pyrite with subordinate galena and chalcopyrite. In these bands the pyrite is present as crystals of variable size set in a matrix of sphalerite, while chalcopyrite and galena occur at the fringes of the veins. Tetrahedrite is only rarely visible. A few lenticular bodies (thickness of a few millimetres) were seen in white quartz where they are associated with pyrite. No visible gold was found.

Pyrite is usually present as scattered crystals or veinlets in the sericite shale, but according to Strauss this rock carries practically no gold.

Under the ore-microscope the *pyrite* is seen as shapeless, separate grains which have a maximum diameter of a few millimetres. These grains are usually arranged along veins and embedded in other ore-minerals, in quartz, or in small seams of sericite. Inclusions of practically all the other ore-minerals are present in the pyrite.

Sphalerite, *galena*, *tetrahedrite*, and *chalcopyrite* usually occur together. The *sphalerite* invariably contains minute inclusions of chalcopyrite, about 10 to 20 microns in diameter, which are in part arranged in rows in the well-known dot-dash pattern. Larger grains of galena, tetrahedrite and chalcopyrite are also present in the sphalerite.

Galena is common as veins and bodies of irregular shape, while tetrahedrite occurs sparingly and is usually intimately associated with the former mineral. Spectrographic tests show that the tetrahedrite contains only very small amounts of arsenic. It is, however, silver-bearing.

Genetically the order of deposition appears to be as follows: Pyrite, sphalerite, tetrahedrite, (chalcopyrite, galena).

Gold is associated with tetrahedrite or more rarely with chalcopyrite and sphalerite. Most of the particles are from 20 to 100 microns in diameter but a few smaller ones were noticed.

Grains of metallic *silver* are present. The grain-size is variable (the largest body measures about $0{\cdot}7 \times 0{\cdot}1$ mm.) and the mineral is usually associated with tetrahedrite. Rarely, silver, associated with tetrahedrite, forms thin films (10μ thick) between quartz and sphalerite. After exhaustive tests, it is inferred that the silver does not carry more than a small percentage of gold.

A very small amount of *enargite* (?) which is present as anhedral grains in tetrahedrite, was found. A few particles of *corynite* (?) the largest of which is about 50 microns in diameter, were likewise observed. Finally a single grain of *bournonite* and clusters of small particles of *violarite* (grain-size 10μ to 20μ) were identified in the ore from Rosetta Mine, the former in tetrahedrite and the latter in chalcopyrite. The properties of these minerals as well as the properties of the silver are given in the table below.

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* C. A. Strauss: Unpublished report.

Volgens Strauss* vorm die wit en die donkerkleurige kwarts twee afsonderlike riwwe in 'n duikende sinklien. Hulle staan onderskeidelik as die „ wit rif " en die „ blou rif " bekend.

Die ertsminerale wat in handmonsters sigbaar is, is die volgende: galeniet, sfaleriet, piriet, chalkopiriet, en tatraëdriet, waarvan laasgenoemde twee minerale baie minder volop as die ander drie is. Die korrelgrootte wissel af met 'n maksimum diameter van 'n paar millimeter. Galeniet en sfaleriet kom gewoonlik saam voor, terwyl piriet dikwels alleen aangetref word. Die donkerkleurige kwarts bevat saamgestelde bande wat bestaan uit sfaleriet en piriet met ondergeskikte galeniet en chalkopiriet. In hierdie bande kom die piriet voor as kristalle van variërende grootte wat in 'n matriks van sfaleriet vassit, terwyl chalkopiriet en galeniet aan die rande van die are voorkom. Tetraëdriet is slegs selde sigbaar. 'n Paar lensagtige liggame ('n paar millimeter dik) is in wit kwarts gesien waar hulle met piriet geassosieer is. Geen sigbare goud is gevind nie.

Piriet kom gewoonlik as verspreide kristalle of aartjies in die serisiet-skalie voor, maar volgens Strauss bevat hierdie gesteente feitlik geen goud nie.

Onder die ertsmikroskoop kan die *piriet* gesien word as vormlose aparte korrels wat 'n maksimum diameter van 'n paar millimeter het. Hierdie korrels is gewoonlik langs are gerangskik of in ander ertsminerale, in kwarts, of in klein serisietaartjies ingesluit. Insluitsels van feitlik al die ander ertsminerale is in die piriet aanwesig.

Sfaleriet, *galeniet*, *tetraëdriet*, en *chalkopiriet* kom gewoonlik saam voor. Die *sfaleriet* bevat altyd klein insluitsels chalkopiriet, sowat 10 tot 20 mikron in diameter, wat gedeeltelik in rye in die bekende punt-en-streep-patroon gerangskik is. Groter korrels galeniet, tetraëdriet en chalkopiriet kom ook in die sfaleriet voor.

Galeniet kom algemeen voor in die vorm van are en liggame van onreëlmatige vorm, terwyl tetraëdriet skaars is en gewoonlik in noue assosiasie met eersgenoemde mineraal voorkom. Spektrografiese toetse toon aan dat tetraëdriet slegs baie klein hoeveelhede arseen bevat. Dit is egter silwerhoudend.

Geneties wil dit voorkom asof die afsettingsvolgorde soos volg was: Piriet, sfaleriet, tetraëdriet, (chalkopiriet, galeniet).

Goud is met tetraëdriet geassosieer en meer selde met chalkopiriet en sfaleriet. Die meeste van die deeltjies is van 20 tot 100 mikron in diameter, maar 'n paar kleineres is opgemerk.

Korrels gedeë *silwer* is aanwesig. Die korrelgrootte varieer (die grootste liggaam is ongeveer $0 \cdot 7 \times 0 \cdot 1$ mm. in grootte) en die mineraal is gewoonlik met tetraëdriet geassosieer. In seldsame gevalle vorm silwer wat met tetraëdriet geasosieer is dun lagies (10μ dik) tussen kwarts en sfaleriet. Na uitvoerige toetse word daar afgelei dat die silwer nie meer as 'n klein persentasie goud bevat nie.

'n Baie klein hoeveelheid *enargiet* (?) wat as oneievormige korrels in tetraëdriet voorkom, is gevind. 'n Paar *korinietdeeltjies* (?) waarvan die grootste ongeveer 50 mikron in diameter is, is ook opgemerk.

Ten slotte is een enkele korrel *bournoniet* en trossies klein deeltjies *violariet* (korrelgrootte 10μ tot 20μ) in die erts van Rosettamyn geïdentifiseer, eersgenoemde in tetraëdriet en laasgenoemde in chalkopiriet. Die eienskappe van hierdie minerale, asook van silwer, word in onderstaande tabel aangegee.

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* C. A. Strauss: Ongepubliseerde verslag.

TABLE No. 2.—PROPERTIES OF MINERALS FROM THE ROSETTA MINE

	Silver	Enargite	Corynite	Bournonite	Violarite
Composition.....	Ag	$Cu_3As\ S_4$	Ni (Sb, As) S	Cu Pb Sb S_3	$(Ni, Fe)_3S_4$
Colour.....	white	reddish-brown	light gray	gray	light gray with pinkish tinge.
Hardness.....	softer than tetrahedrite	similar to that of tetrahedrite	much harder than tetrahedrite	similar to that of tetrahedrite	somewhat harder than chalcopyrite
Anisotropism.....	isotropic	strong	isotropic	rather weak, lamellar twinning in two directions visible	isotropic.
Reflectivity (in oil)....	red 90·4%, green 84·5%	red 10·7%, green 9·3%	red 34%, green 44%	red 14·8%, green 19·6%	red 27·3%, green 30·4%.
Etch-reactions.....	HCl pos., HNO_3 strong pos., KCN strong pos., $FeCl_3$ strong pos.	HCl neg., HNO_3 neg., KCN strong pos., $FeCl_3$ neg.	HCl neg., HNO_3 some grains weak pos. others neg., KCN, $FeCl_3$ neg.	HCl neg., HNO_3 neg., $FeCl_3$ neg., KCN neg.	HCl neg., HNO_3 weak pos., KCN neg., $FeCl_3$ neg.
Constituents.....	Ag (+ Sb from tetrahedrite and Zn from sphalerite)	As (+ Sb from tetrahedrite)	Ni and a little As (+ Sb chiefly from tetrahedrite)	—	Ni, also Fe—no Co, Bi, As.

TABEL No. 2.—EIENSKAPPE VAN MINERALE VAN DIE ROSETTAMYN

	Silwer	Enargiet	Koriniet	Bournoniet	Violariet
Samestelling.....	Ag	$Cu_3As\ S_4$	Ni (Sb, As) S	Cu Pb Sb S_3	$(Ni, Fe)_3S_4$.
Kleur.....	wit	rooibruin	liggrys	grys	liggrys met 'n tikkie ligroos.
Hardheid.....	sagter as tetraëdriet	dieselfde as dié van tetraëdriet	baie harder as tetraëdriet	dieselfde as dié van tetraëdriet	'n bietjie harder as chalkopiriet.
Anisotropisme.....	isotroop	sterk	isotroop	taamlik swak; lamellêre vertweelinging in twee rigtings sigbaar	isotroop.
Reflektiwiteit (in olie)	rooi 90·4%, groen 84·5%	rooi 10·7%, groen 9·3%	rooi 34%, groen 44%	rooi 14·8%, groen 19·6%	rooi 27·3%, groen 30·4%.
Ertsreaksies.....	HCl pos., HNO_3 sterk pos., KCN sterk pos., $FeCl_3$ sterk pos.	HCl neg., HNO_3 neg., KCN sterk pos., $FeCl_3$ neg.	HCl neg., HNO_3 sommige korrels swak pos. ander neg., KCN, $FeCl_3$ neg.	HCl neg., HNO_3 neg., $FeCl_3$ neg., KCN neg.	HCl neg., HNO_3 swak pos., KCN neg., $FeCl_3$ neg.
Bestanddele.....	Ag (+ Sb van tetraëdriet en Zn van sfaleriet)	As (+ Sb van tetraëdriet)	Ni en 'n bietjie As (+ Sb hoofsaaklik van tetraëdriet)	—	Ni, asook Fe—geen Co, Bi, As.

B. Alfström Mine

The ore-bearer of this property, which lies about five miles northeast of Barberton, consists mainly of vein quartz, which is fairly coarse-grained and whose contact with the wall-rock dolomite is usually well defined. The dolomitic rock usually shows vague foliation, and is composed chiefly of somewhat ferriferous dolomite with green, chromiferous muscovite, " chert ", and felspar.

Galena, the common sulphide in the ore, is present in small amounts and forms bodies of irregular shape. Sphalerite occurs in addition to the galena. A few small grains of pyrite are present, but unlike the galena and sphalerite they occur mostly in the altered dolomite. Finally, a few particles of gold were observed peripherally in the quartz veins.

Under the ore-microscope the *galena* and *sphalerite* have the usual properties. These two minerals are intimately associated with *pyrite*, which is often present along the contact between sphalerite and quartz. The pyrite usually occurs as fairly well-formed crystals, some of which contain inclusions of galena or sphalerite, in part as small particles arranged like beads on a string.

V.—THE ANTIMONIAL ORE

A. General

Ore in which stibnite is the main sulphide is found at a number of localities in the Barberton District and in the course of the present study samples from the New Consort Mine, Amo, and Bellevue were examined. At the time of the visit no antimonial ore was being mined, either for its antimony- or for its gold-content, in the area around Barberton.

B. The Amo Deposit

The Amo workings are situated on the farm Malelane 1051 near the railway station of the same name. The ore-bearer from this locality shows a rude foliation and is composed of carbonate (mainly ferriferous magnesite) and " chert " with some chlorite and a little coarse-grained quartz. Stibnite, the only sulphide seen in hand-specimens, is present as bodies of irregular shape and veinlets that traverse the samples at all angles to the planes of foliation.

Under the ore-microscope *stibnite* shows mosaic structure. The mineral has normal microscopic and physical properties and many grains show the characteristic lamellar twinning. Small amounts of *pyrite* (in the form of isolated grains, a few hundredths of a millimetre in diameter) are present mainly in the gangue.

One small grain of *jamesonite* was identified within the stibnite, which it resembles very closely. Its identification was confirmed spectrographically by the detection of major amounts of antimony and lead.

C. The New Consort Mine

Samples of antimonial ore were obtained from a section of the New Consort Mine which was not being worked at the time (No. 3 Shaft, Bottom Section). The ore-bearer consists of fine-grained quartz with streaks and layers of green chromiferous muscovite and small amounts of albite. Stibnite and arsenopyrite form veinlets and patches of irregular shape in the rock; the arsenopyrite also occurs as small scattered crystals in the gangue.

B. Alfströmmyn

Die ertsdraer van hierdie eiendom wat sowat vyf myl noordoos van Barberton lê, bestaan hoofsaaklik uit aarkwarts wat taamlik grofkorrelrig is en waarvan die kontak met die wandgesteentedolomiet gewoonlik duidelik is. Die dolomitiese gesteente toon gewoonlik vae foliasie en bestaan hoofsaaklik uit dolomiet wat in 'n mate ysterhoudend is en groen, chroombevattende muskoviet, „ chert ", en veldspaat.

Galeniet, die sulfied wat algemeen in die erts voorkom, is aanwesig in klein hoeveelhede en vorm liggame van onreëlmatige vorm. Benewens galeniet kom sfaleriet ook voor. 'n Paar klein korrels piriet is aanwesig, maar anders as die galeniet en sfaleriet, kom hulle meestal in die veranderde dolomiet voor. Ten slotte is 'n paar deeltjies goud langs die buiterande van die kwartsare opgemerk.

Onder die ertsmikroskoop het die *galeniet* en *sfaleriet* die gewone eienskappe. Hierdie twee minerale is baie nou met *piriet* geassosieer wat gewoonlik langs die kontak tussen sfaleriet en kwarts aanwesig is. Die piriet kom gewoonlik voor as betreklik goed gevormde kristalle waarvan sommige insluitsels van galeniet of sfaleriet bevat wat deels as klein deeltjies soos stringe krale gerangskik is.

V.—DIE ANTIMOONBEVATTENDE ERTS

A. Algemeen

Erts waarin stibniet die vernaamste sulfied is, word op 'n aantal plekke in die Distrik Barberton aangetref, en in die loop van hierdie studie is monsters van die myne New Consort, Amo en Bellevue ondersoek. Ten tyde van die besoek is daar in die gebied om Barberton geen antimoonbevattende erts, hetsy vir die antimoon- of vir die goudinhoud daarvan, ontgin nie.

B. Die Amo-afsettings

Die Amowerkplekke is geleë op die plaas Malelane 1051 naby die spoorwegstasie met dieselfde naam. Die ertsdraer hiervandaan afkomstig toon 'n ruwe foliasie en bestaan uit karbonaat (hoofsaaklik ysterhoudende magnesiet) en „ chert " met 'n hoeveelheid chloriet en 'n bietjie grofkorrelrige kwarts. Stibniet, die enigste sulfied wat in handmonsters waargeneem is, kom voor as liggame van onreëlmatige vorm en aartjies wat uit alle hoeke teen die foliasievlakke deur die monsters loop.

Onder die ertsmikroskoop toon *stibniet* 'n mosaïekstruktuur. Die mineraal het normale mikroskopiese en fisiese eienskappe en baie korrels toon die kenmerkende lamellêre vertweelinging. Klein hoeveelhede *piriet* (in die vorm van geïsoleerde korrels, 'n paar honderdstes van 'n millimeter in diameter) is hoofsaaklik in die aarsteen aanwesig.

Een klein korrel *jamesoniet* is in die stibniet, waarmee dit baie nou ooreenstem, geïdentifiseer. Die identifikasie daarvan is spektrografies bevestig deur die bespeuring van aansienlike hoeveelhede antimoon en lood.

C. Die New Consortmyn

Monsters van antimoonbevattende erts is verkry van 'n afdeling van die New Consortmyn wat indertyd nie ontgin is nie. (Skag No. 3, Onderste Afdeling). Die ertsdraer bestaan uit fynkorrelrige kwarts met strepe en lae groen chroombevattende muskoviet en klein hoeveelhede albiet. Stibniet en arseenpiriet vorm aartjies en kolle van onreëlmatige vorm in die rots; die arseenpiriet kom ook voor as klein verspreide kristalle in die aarsteen.

Under the ore-microscope the *stibnite* is coarsely crystalline and has the usual optical and physical properties. *Arsenopyrite* is present both in the stibnite and in the gangue. It forms crystals, many of which (like those from other parts of the same mine) show the effects of corrosion and brecciation.

Marcasite, which is fairly coarsely crystalline, is plentiful in a few polished sections of weathered ore. It is younger than the arsenopyrite but seems older than the stibnite since veinlets of the latter mineral are present in the marcasite.

Small amounts of *berthierite* were frequently found. It is coarsely crystalline and intimately associated with stibnite, which may vein it. Like jamesonite, the berthierite closely resembles stibnite. The reflectivity (in oil) is: green (bright position) 25 per cent, green (dark position) 17·5 per cent; red (bright position) 24 per cent, red (dark position) 17 per cent. A spectrographic examination of a small sample of the powder showed that in addition to antimony, only iron is present.

Metallic *antimony* is frequently present and it usually forms small ragged particles, 10 microns or less in diameter, in stibnite. It is most plentiful in the weathered specimens. In these samples the grains are larger (up to 75μ in diameter) and occur both in the stibnite and in the marcasite.

D. Bellevue Mine

The samples of antimonial ore obtained from this mine which lies about sixteen miles southwest of Barberton are all considerably weathered. They consist of vein quartz with stibnite, iron oxides, and weathering-products of antimonial minerals. Small amounts of pyrite are present in a few specimens as clusters of crystals (average diameter a few tenths of a millimetre) associated with stibnite, or as ill-defined veinlets in quartz.

Examination of polished sections show that in addition to *stibnite* and *pyrite*, small amounts of *arsenopyrite*, traces of *chalcopyrite*, and *gold* are present. The stibnite forms masses of irregular shape while the pyrite and arsenopyrite occur partly as fairly well-developed crystals and partly as corroded grains which may be embedded in iron and antimony oxides.

The few small grains of chalcopyrite observed, are enclosed in weathering-products. Particles of gold (the largest of which is about 50μ in diameter) and small veinlets of gold were found. They are likewise embedded in weathering-products.

VI.—ORE FROM MINES OUTSIDE THE BARBERTON AREA

A. Mamre Mine

The Mamre Mine is situated about thirty-two miles west of Barberton in a valley debouching into the Komati River. The area is underlain by rocks of the Pretoria Series which is much younger than the strata in the Barberton area. The ore differs in appearance and composition from that of Barberton and the mineralisation is genetically unconnected with that in that area. The mine produces gold, copper, and bismuth.

The ore-bearer consists mainly of vein quartz and siderite with a high percentage of pyrrhotite, pyrite, and chalcopyrite. Small amounts of fine-grained ankerite may also be present. The country-rock is carbonaceous, sericitic shale in which small needles of tourmaline are present. It has not

Onder die ertsmikroskoop is die *stibniet* grofkristallyn en het dit die gewone optiese en fisiese eienskappe. *Arseenpiriet* is in sowel die stibniet as die aarsteen aanwesig. Dit vorm kristalle waarvan baie (soos dié uit ander gedeeltes van dieselfde myn) die uitwerking van korrosie en breksiëring toon.

Markasiet wat taamlik grofkristallyn is, is volop in 'n paar gepoleerde ertsstukke van verweerde erts. Dit is jonger as die arseenpiriet, maar is blykbaar ouer as die stibniet aangesien aartjies van laasgenoemde mineraal in die markasiet voorkom.

Klein hoeveelhede *bertieriet* is dikwels gevind. Dit is grofkristallyn en baie nou geassosieer met stibniet wat aartjies daarin kan vorm. Net soos jamesoniet, lyk bertieriet baie sterk na stibniet. Die reflektiwiteit (in olie) is: groen (helder stand) 25 persent, groen (donker stand) 17·5 persent; rooi (helder stand) 24 persent, rooi (donker stand) 17 persent. Spektrografiese ondersoek van 'n klein monstertjie van die poeier het getoon dat, benewens antimoon, net yster aanwesig is.

Gedeë *antimoon* kom dikwels voor en dit vorm gewoonlik klein getande deeltjies, 10 mikron of minder in diameter, in stibniet. Dit is die volopste in die verweerde monsters. In hierdie monsters is die korrels groter (tot 75μ in diameter) en kom in sowel die stibniet as die markasiet voor.

D. Bellevuemyn

Die monsters antimoonbevattende erts verkry van hierdie myn wat ongeveer sestien myl suidwes van Barberton geleë is, is almal heelwat verweer. Hulle bestaan uit aarkwarts met stibniet, ysteroksiede, en verweringsprodukte van antimoonbevattende minerale. Klein hoeveelhede piriet is aanwesig in 'n paar monsters in die vorm van trossies kristalle (gemiddelde diameter 'n paar tiendes van 'n millimeter) wat met stibniet geassosieer is, of as onduidelike aartjies in die kwarts.

Uit die ondersoek van gepoleerde ertsstukke blyk dat, benewens *stibniet* en *piriet*, klein hoeveelhede *arseenpiriet*, spore van *chalkopiriet*, en *goud* voorkom. Die stibniet vorm massas van onreëlmatige vorm, terwyl die piriet en arseenpiriet deels as taamlik goed ontwikkelde kristalle en deels as gekorrodeerde korrels wat in yster- en antimoonoksiede ingesluit kan wees, voorkom.

Die paar klein korrels chalkopiriet wat opgemerk is, is in verweringsprodukte omsluit. Deeltjies goud (waarvan die grootste ongeveer 50μ in diameter is) en klein aartjies goud is gevind. Hulle is insgelyks in verweringsprodukte ingesluit.

VI.—ERTS VAN MYNE BUITE DIE GEBIED BARBERTON

A. Mamremyn

Die Mamremyn is sowat twee-en-dertig myl ten weste van Barberton geleë in 'n vallei wat in die Komatirivier uitmond. Die gebied lê op gesteentes van die Serie Pretoria wat baie jonger as die lae in die Gebied Barberton is. Die erts lyk anders en is anders saamgestel as dié van Barberton en die mineralisering is geneties nie verbonde aan dié in laasgenoemde gebied nie. Die myn produseer goud, koper en bismut.

Die ertsdraer bestaan hoofsaaklik uit aarkwarts en sideriet met 'n hoë persentasie pirrotiet, piriet, en chalkopiriet. Klein hoeveelhede fynkorrelrige ankeriet kan ook voorkom. Die newegesteente is koolstofhoudende, serisitiese skalie waarin klein naaldjies toermalyn aanwesig is. Dit het nie

undergone any marked degree of alteration and the contacts between the vein quartz and shale are clear-cut and sharp. The vein quartz, carbonate, and sulphide are coarsely crystalline and are unaffected by brecciation or shearing.

The sulphide may be present either as masses of irregular shape, many centimetres across, or as networks of small veins. Well-formed crystals of pyrite are not plentiful.

Under the ore-microscope it is seen that the sulphide (with the exception of occasional crystals of pyrite) shows no tendency to euhedralism. Small veins of *chalcopyrite* are often present in *pyrrhotite*. The former mineral is thus younger than the latter. The *pyrite* crystals usually have crystal boundaries where they are in contact with chalcopyrite and carbonate. In part, however, they are replaced by pyrrhotite and chalcopyrite.

Cubanite lamellae are plentiful in chalcopyrite while a few fragments of coarse *marcasite* were observed in pyrrhotite.

Particles of metallic *bismuth* averaging about 15 microns in diameter are present in the chalcopyrite. The reflectivity and etch-reactions of this mineral are similar to those of bismuth in the ore from the New Consort Mine.

Gold is present chiefly in chalcopyrite, although a few small grains were found in pyrrhotite. Most of the particles are very small (diameter less than 10μ), but one fairly large grain ($0 \cdot 25 \times 0 \cdot 1$ mm.) was observed. The small grains of gold resemble the particles of bismuth very closely, but measurement of the reflectivity by means of the photometer usually sufficed to distinguish them.

B. Rietfontein (Sabie) Mine

The Rietfontein Mine lies about fifty miles north of Barberton near the village of Sabie. Ore from this property has been examined by Swiegers ([10]) who states that the hypogene minerals represented are pyrite, arsenopyrite, and chalcopyrite. These results are in accord with the findings of the present writer.

The ore-body consists of vein quartz, sulphide, weathering-products, and a little ankerite and occupies a more or less vertical fissure in Archaean Granite. The deposit is apparently related genetically to those in the neighbouring Transvaal System and is therefore much younger than the ore in the Barberton Area.

The contact between the vein quartz and the granite is clear-cut; the felspar of the latter rock is almost completely sericitised. Pyrite is the main sulphide present, but chalcopyrite and small amounts of arsenopyrite are also visible in hand-specimens. Many of the samples are highly weathered and have a vuggy texture. They consist of sulphide and weathering-products of iron and copper. In some specimens, small bodies of partially weathered ankerite are present.

The pyrite occurs as grains (average size about a millimetre) which are scattered through the vein quartz and altered granite, and as larger masses (which may be many centimetres across) in quartz. These masses are generally fine-grained but a few partially euhedral crystals of pyrite (about 3 centimetres in diameter) were noticed. A slight degree of brecciation of the ore is indicated by cracks in the pyrite which have been filled by quartz. Spectrographic tests showed that small amounts of nickel are present in the pyrite.

'n groot mate van verandering ondergaan nie en die kontakte tussen die aarkwarts en skalie is duidelik en skerp. Die aarkwarts, karbonaat, en sulfied is grofkristallyn en is nie deur breksiëring of skuifskeuring aangetas nie.

Die sulfied kan òf as massas met 'n onreëlmatige vorm, etlike centimeter wyd, aanwesig wees, òf as netwerke van klein are. Goed gevormde kristalle van piriet is nie volop nie.

Onder die ertsmikroskoop kan gesien word dat die sulfied (met uitsondering van enkele kristalle piriet) geen neiging tot eievormigheid toon nie. Klein aartjies van *chalkopiriet* is dikwels aanwesig in *pirrotiet*. Eersgenoemde mineraal is dus jonger as laasgenoemde. Waar hulle met chalkopiriet en karbonaat in kontak is, het die kristalle *piriet*, gewoonlik kristalgrenslyne. Hulle word egter deels deur pirrotiet en chalkopiriet vervang.

*Kubaniet*blaadjies is volop in chalkopiriet, terwyl 'n paar brokke growwe *markasiet* in pirrotiet opgemerk is.

Deeltjies gedeë *bismut* wat gemiddeld ongeveer 15 mikron in diameter is, kom in die chalkopiriet voor. Die reflektiwiteit en ertsreaksies van hierdie mineraal is soortgelyk aan dié van bismut in die erts van die New Consortmyn.

Goud kom hoofsaaklik in chalkopiriet voor, ofskoon 'n paar klein korreltjies in pirrotiet gevind is. Die meeste van die deeltjies is baie klein (diameter minder as 10μ) maar één taamlike groot korrel (0·25 × 0·1 mm.) is opgemerk. Die klein korreltjies goud lyk baie sterk na die bismutdeeltjies maar die meting van die reflektiwiteit met behulp van die fotometer is gewoonlik voldoende om hulle te onderskei.

B. Rietfontein- (Sabie-) myn

Die Rietfonteinmyn lê ongeveer vyftig myl noord van Barberton naby die dorpie Sabie. Erts van hierdie eiendom is deur Swiegers ([10]) ondersoek wat verklaar dat die hipogene minerale wat verteenwoordig is, piriet, arseenpiriet, en chalkopiriet is. Hierdie resultate is in ooreenstemming met die bevindings van die skrywer.

Die ertsliggaam bestaan uit aarkwarts, sulfied, verweringsprodukte, en 'n bietjie ankeriet, en beslaan 'n min of meer vertikale spleet in Argeïese graniet. Die afsetting is blykbaar geneties verwant aan dié in die aangrensende Sisteem Transvaal en is dus baie jonger as die erts in die Gebied Barberton.

Die kontak tussen die aarkwarts en die graniet is skerp; die veldspaat van laasgenoemde gesteente is feitlik geheel en al geserisitiseer. Piriet is die vernaamste sulfied wat aanwesig is, maar chalkopiriet en klein hoeveelhede arseenpiriet is ook in handmonsters sigbaar. Baie van die monsters is erg verweer en wat tekstuur betref, is hulle vol kristalholtes. Hulle bestaan uit sulfied en verweringsprodukte van yster en koper. In sommige monsters is klein liggame van gedeeltelik verweerde ankeriet aanwesig.

Die piriet kom voor as korrels (gemiddelde grootte ongeveer een millimeter) wat deur die aarkwarts en veranderde graniet versprei is, en as groter massas (wat etlike centimeters breed kan wees) in kwarts. Hierdie massas is gewoonlik fynkorrelrig, maar 'n paar gedeeltelik eievormige kristalle piriet (ongeveer 3 centimeter in diameter) is opgemerk. 'n Geringe mate van breksiëring van die erts word aangedui deur barste in die piriet wat met kwarts gevul is. Spektrografiese toetse het bewys dat klein hoeveelhede nikkel in die piriet aanwesig is.

Coarse-grained masses of chalcopyrite are present. Arsenopyrite was found as equant, hypidiomorphic grains. These grains, together with crystals of pyrite of similar size, are scattered through the quartz.

Under the ore-microscope the *pyrite* may show a faint zonal structure which is defined by variations in the quality of the polish of the different zones. Etching with hydrochloric acid and zinc powder makes the structure clearly visible.

Chalcopyrite occurs as large masses and as small irregular bodies and veinlets in pyrite. *Arsenopyrite* is associated with pyrite, the contact between the two minerals being usually sharp. Layers and streaks of arsenopyrite, 10μ — 100μ in thickness, appear to have replaced pyrite along crystallographic directions. Traces of *pyrrhotite* are present in pyrite as small grains of irregular shape.

Small bodies of *sphalerite* sometimes occur in chalcopyrite.

Gold was observed in two instances. Firstly, as a few grains, 10μ — 30μ in diameter, on the contact between pyrite and small blebs of chalcopyrite (or in the chalcopyrite); secondly as a minute particle, about 2μ in diameter, in pyrite.

VII.—COMPOSITION OF THE GOLD CONCENTRATES

Samples of gold concentrates were obtained from a number of mines in the Eastern Transvaal. These were examined spectrographically and a number was assigned to each constituent to indicate its relative abundance in the sample. Where the amount of an element present is indicated by the number 0, no spectral lines due to that element were found, while the number 10 was used where the lines of the elements appeared at maximum intensity. If the amount of one constituent present is given by a number and the amount of another by the same number, it does not mean that the percentages of the two constituents are equal or even comparable. The lines of one element may be at maximum intensity at 1 per cent and that of another at 10 per cent. If an element in one concentrate has the same number as that element in a different concentrate, the percentages of the element present in the two samples will usually be comparable, although differences in the overall composition of the samples will affect the intensity of the lines.

Special attention was paid to the detection of tellurium and selenium in the concentrates. It is difficult to detect small amounts of these elements (especially selenium) by means of the spectrograph, but this difficulty was to some extent overcome by repeated arcings. By this method 0·1 per cent Se and 0·1 per cent Te could be detected with certainty. The selenium line at 2413·5Å and the tellurium lines at 2383·3Å and 2385Å were used for these determinations.

Where the " richest fraction " is mentioned in Table 3, the sample is usually a concentrate from the James Table collected at the mine. In the case of the Rietfontein Mine, the " richest fraction " is a mine concentrate which was further concentrated by hand-panning. Concentrates from Forbes Reef and Forbes Reef (western workings) were prepared by panning several pounds of sand from the dumps. The quantitative chemical determination of a number of elements was carried out by Mr. C. J. Liebenberg of the Division of Chemical Services, and the results of the spectrographic and chemical analyses are given in tables No. 3 and No. 4.

Grofkorrelrige massas chalkopiriet kom voor. Arseenpiriet is aangetref as ekwante, hipidiomorfe korrels. Hierdie korrels is, tesame met kristalle piriet van gelyke grootte, deur die kwarts versprei.

Onder die ertsmikroskoop toon die *piriet* 'n effense sonestruktuur wat deur afwisselings in die gehalte van polysting van die verskillende sones gedefinieer word. Deur die piriet met soutsuur en sinkpoeier te ets, word die struktuur duidelik sigbaar gemaak.

Chalkopiriet kom as groot massas en as klein onreëlmatige liggame en aartjies in piriet voor. *Arseenpiriet* is met piriet geassosieer en die kontak tussen die twee minerale is gewoonlik skerp. Dit lyk of lae en strepe van arseenpiriet, 10μ–100μ dik, piriet langs kristallografiese rigtings vervang het. Spore van *pirrotiet* in die vorm van klein korrels van onreëlmatige vorm is in piriet aanwesig.

Klein liggame van *sfaleriet* kom soms in chalkopiriet voor.

Goud is in twee gevalle opgemerk. Eerstens, as 'n paar korrels, 10μ–30μ in diameter, op die kontak tussen piriet en klein spikkeltjies chalkopiriet (of in die chalkopiriet); tweedens as 'n baie klein deeltjie, sowat 2μ in diameter, in piriet.

VII.—SAMESTELLING VAN DIE GOUDKONSENTRATE

Monsters van goudkonsentrate is van 'n aantal myne in Oos-Transvaal verkry. Hulle is spektrografies ondersoek en 'n nommer is aan elke bestanddeel toegeken om sy relatiewe volopheid in die monster aan te dui. Waar die hoeveelheid van die aanwesige element met die syfer 0 aangedui word, is geen spektrumlyne wat deur daardie element afgegee word, aangetref nie, terwyl die syfer 10 gebruik is waar die lyne van die elemente met maksimum intensitiet voorgekom het. As die hoeveelheid van een aanwesige bestanddeel met 'n nommer aangedui word en die hoeveelheid van 'n ander mineraal deur dieselfde nommer, beteken dit nie dat die persentasie van die twee gelyk is of selfs met mekaar vergelyk kan word nie. Die lyne van een element kan by 1 persent op maksimum intensiteit wees en dié van 'n ander by 10 persent. As 'n element in een konsentraat dieselfde nommer het as daardie element in 'n ander konsentraat, is die persentasie van die element wat in die twee monsters aanwesig is, gewoonlik vergelykbaar, ofskoon verskille in die totale samestelling van die monsters die intensitent van die lyne kan beïnvloed.

Spesiale aandag is aan die bespeuring van telluur en seleen in die konsentrate geskenk. Dit is moeilik om klein hoeveelhede van hierdie elemente (veral seleen) met behulp van die spektrograaf te bespeur, maar hierdie moeilikheid is in 'n mate te bowe gekom deur herhaalde vergloeiings. Hierdeur kan die aanwesigheid van 0·1 persent Se en 0·1 persent Te met sekerheid bepaal word. Die seleenlyn by 2413·5Å en die telluurlyne by 2383·3Å en 2385Å is vir hierdie bepalings gebruik.

Waar die „ rykste fraksie " in Tabel 3 genoem word, is die monster gewoonlik 'n konsentraat afkomstig van die Jamestafel by die myn. In die geval van die Rietfonteinmyn is die „ rykste fraksie " 'n konsentraat wat deur handpanwassing verder gekonsentreer is.

Konsentrate van Forbes Reef en Forbes Reef (westelike delfplekke) is berei deur etlike ponde sand van die hope te pan. Die kwantitatiewe chemiese bepaling van 'n aantal elemente is deur Mnr. C. J. Liebenberg van die Afdeling Skeikundige Diens uitgevoer en die resultate van die spektrografiese en skeikundige ontledings word in tabelle Nos. 3 en 4 gegee.

TABLE No. 3.—COMPOSITION OF GOLD CONCENTRATES FROM BARBERTON

No.	Concentrate	Ag	Au	Sb	As	Ni	Co	Bi	Zn	Pb	W
1	Rosetta Mine	6	4	4	0	1	1	0–1	6	4	0
2	Rosetta Mine, richest fraction	6	6	5	0	0	1	1	6	5	0
3	Agnes Mine	4	3	0	0	4	3	0	0	2	0
4	Fairview Mine, gravity-concentrate	3	4	2	8	1	1	0	0	2	0
5	Fairview Mine, flotation-concentrate	2	3	0	5	2	3	0	0	0	0
6	Fairview Mine, per Mr. G. K. Joubert	6–7	8	1	8	3	4	0	2–3	3	1
7	Alpine Mine	5	6	4	1–2	6	6	0	0	0	0
8	Sheba Mine	5	5	1–2	2	5	5	0	0	1	0
9	Sheba Mine, richest fraction	7	7	1	4	4	3	0	0	0	5
10	New Consort Mine	5	4–5	3	8	7	6	0	0	3	0
11	New Consort Mine, richest fraction	9	8	3	6	6	5	0	0	1	3
12	Golden Quarry Mine	6–7	8	0	2	2	1	0	0	2	0
13	Golden Quarry Mine, per Dr. L. G. Boardman	5	8	0–1	8	4	1	0	0	0	—
14	Three Sisters Mine, Corduroy-conc	5	4	0	0	2	4	0	0–1	0	0
15	Three Sisters Mine, midlings	6–7	7	0	0	1	3	0	0–1	1	0
16	Pigg's Peak Mine	6	7	2	10	6	4	0	0	2	1
17	Woodstock Mine	6	5	1	1–2	7	6	0	0	0	0
18	Mamre Mine	0	0	0	0	0–1	1	0	0	4	0
19	Mamre Mine, richest fraction	8	6	2	2	1	5	8	0	0–1	0
20	Rietfontein (Sabie) Mine	1	0	0	2	0	1	0–1	0	0	0
21	Rietfontein (Sabie) Mine, richest fraction	2	1	0	4	0–1	2	0	0	0	0
22	Forbes Reef	0	0	0	0	0–1	0–1	0	0	1	0
23	Forbes Reef, western workings	0	0	1	0	1	0	0	0		

Molybdenum: Intensity 2 in Mamre Mine (richest fraction), intensity 1 in Forbes Reef (western workings); in other samples, absent.

Tellurium: Very small percentage in Mamre Mine (richest fraction), in other samples absent.

Selenium: Trace in Forbes Reef (western workings); in other samples absent.

Tin: Very small amounts in Pigg's Peak, Woodstock, Fairview and Sheba mines (richest fractions); in other samples absent (see determination of tin in Table 4). Germanium, thallium, platinum metals: absent.

TABEL No. 3.—SAMESTELLING VAN GOUDKONSENTRATE VAN BARBERTON

No.	Konsentraat	Ag	Au	Sb	As	Ni	Co	Bi	Zn	Pb	W
1	Rosettamyn	6	4	4	0	1	1	0–1	6	4	0
2	Rosettamyn, rykste fraksie	6	6	5	0	0	1	1	6	5	0
3	Agnesmyn	4	3	0	0	4	3	0	0	2	0
4	Fairviewmyn, swaartekonsentraat	3	4	2	8	1	1	0	0	2	0
5	Fairviewmyn, flotteringskonsentraat	2	3	0	5	2	3	0	0	0	0
6	Fairviewmyn, per mnr. G. K. Joubert	6–7	8	1	8	3	4	0	2–3	0	1
7	Alpinemyn	5	6	4	1–2	6	6	0	0	3	0
8	Shebamyn	5	5	1–2	2	5	5	0	0	0	0
9	Shebamyn, rykste fraksie	7	7	1	4	4	3	0	0	1	5
10	New Consortmyn	5	4–5	3	8	7	6	0	0	0	0
11	New Consortmyn, rykste fraksie	9	8	3	6	6	5	0	0	3	3
12	Golden Quarrymyn	6–7	8	0	2	2	1	0	0	1	0
13	Golden Quarrymyn, per dr. L. G. Boardman	5	8	0–1	8	4	1	0	0	2	—
14	Three Sistersmyn, ferweeltafelkonsentraat	5	4	0	0	2	4	0	0	0	0
15	Three Sistersmyn, middelskot	6–7	7	0	0	1	3	0	0–1	0	0
16	Pigg's Peakmyn	6	7	2	10	6	4	0	0–1	1	0
17	Woodstockmyn	6	5	1	1–2	7	6	0	0	2	1
18	Mamremyn	0	0	0	0	0–1	1	0	0	0	0
19	Mamremyn, rykste fraksie	8	6	2	2	1	5	8	0	4	0
20	Rietfontein- (Sabie-) myn	1	0	0	2	0	1	0–1	0	0–1	0
21	Rietfontein- (Sabie-) myn, rykste fraksie	2	1	0	4	0–1	2	0	0	0	0
22	Forbes Reef	0	0	0	0	0–1	0–1	0	0	0	0
23	Forbes Reef, westelike delfplekke	0	0	1	0	1	0	0	0	1	0

Molibdeen: Intensiteit 2 in Mamremyn (rykste fraksie), intensiteit 1 in Forbes Reef (westelike delfplekke); ontbreek in ander monsters.
Telluur: Baie klein persentasie in Mamremyn (rykste fraksie); ontbreek in ander monsters.
Seleen: Spoor in Forbes Reef (westelike delfplekke); ontbreek in ander monsters.
Tin: Baie klein hoeveelhede in Pigg's Peak-, Woodstock-, Fairview- en Shebamyn (rykste fraksies); ontbreek in ander monsters (sien bepaling van tin in tabel 4). Germanium, tallium, platinummetale: ontbreek.

TABLE No. 4.—CHEMICAL ANALYSIS OF CONCENTRATES*

	2	7	10	15	6	16	0
Ag.....	tr.	tr.		tr.	tr.		tr.
Sb.....	0·41	0·67	0·13			no	0·47
Bi.....	tr.					tin	Fe, 43·12
Zn.....	0·17						0·09
Pb.....	8·9	tr.					9·5
Cu.....	0·3	0·17	0·05	0·01			9·3
As.....		tr.	23·8				S, 30·38
Ni.....		0·15	1·19				tr.
Co.....		0·16	0·36				Au, 88 oz./ton.

Analyst: Mr. C. J. Liebenberg.

VIII.—ORIGIN AND PARAGENESIS

The writer believes that the gold deposits of the Barberton District were all formed during a single metallogenic age. The ore containing pyrrhotite and arsenopyrite, the pyritic ore, and the lead-bearing ore have different mineral assemblages, but they show a textural resemblance to one another, while transitional types exist, as between the pyrrhotite-bearing and pyritic ore (exemplified in the Eagle's Nest deposit), and as between the pyritic and lead-bearing ore, (exemplified in the Alpine deposit). Furthermore, traces of minerals characteristic of one type often occur in ore of the other types.

There is less evidence to show that the stibnite ore is related to the rest of the gold ore from Barberton. No stibnite has been found in the ore characterised by pyrrhotite, pyrite, or galena-tetrahedrite; neither has tetrahedrite been found in any of the samples of stibnite examined. Nevertheless, the striking resemblance between the ore from Barberton and that from the Murchison Range suggests that these ores may be of the same metallogenic age, and this suggestion is supported by the fact that the antimonial deposits are distributed throughout the Barberton area.

The gold occurrences of the Murchison Range, which lies about a hundred and thirty miles to the north of Barberton have been described in detail by O. R. van Eeden, F. C. Partridge, and others ([12]). Various types of ore occur in that area, but the minerals are not distributed between the types in quite the same way as in the Barberton area. Tetrahedrite, for instance, occurs in the stibnite-bearing ore and not in the lead-bearing ore. On the whole, the similarity of the mineral assemblage to that of the Barberton deposits is remarkable, even such comparatively rare minerals as berthierite, corynite, cinnabar, and enargite (or famatinite) being represented in both areas.

Like those at Barberton, the Murchison deposits occur in Archean strata which are surrounded and intruded by Archean basic and granitic rocks with granite of the Nelspruit type as the final phase. Partridge states that " the mineralisation in general (of the Murchison Range) then belongs to one metallogenic period ". If this view is correct a similar relationship may be expected to exist between these ore-types in the Barberton area, too.

* The numbers of the samples correspond to those in the previous table except No. 0 which is a sample of concentrates from Rosetta Mine submitted for analysis by C. A. Strauss.

TABEL No. 4.—SKEIKUNDIGE ONTLEDING VAN KONSENTRATE*

	2	7	10	15	6	16	0
Ag.....	tr.	tr.		tr.	tr.		tr.
Sb.....	0·41	0·67	0·13			geen	0·47
Bi.....	tr.					tin	Fe, 43·12
Zn.....	0·17						0·09
Pb.....	8·9	tr.					9·5
Cu.....	0·3	0·17	0·05	0·01			9·3
As.....		tr.	23·8				S, 30·38
Ni.....		0·15	1·19				tr.
Co.....		0·16	0·36				Au, 88 ons/ton.

Analis: Mnr. C. J. Liebenberg.

VIII.—OORSPRONG EN PARAGENESE

Die skrywer is van mening dat die goudafsettings van die Distrik Barberton almal gedurende een enkele metallogeniese tydperk gevorm is. Die erts wat pirrotiet en arseenpiriet bevat, die piritiese erts, en die loodbevattende erts het almal verskillende mineraalgroeperings, maar hulle toon 'n struktuurooreenkoms met mekaar, terwyl oorgangstipes ook bestaan, soos bv. tussen die pirrotietdraende en piritiese erts (soos aangetoon in die Eagle's Nestafsetting), en tussen die piritiese en looddraende erts (soos aangetoon in die Alpine-afsetting). Verder kom spore van minerale wat kenmerkend van een tipe is, dikwels in erts van die ander tipes voor.

Daar is minder getuienis om aan te toon dat die stibnieterts aan die res van die gouderts van Barberton verwant is. Geen stibniet is in die erts wat deur pirrotiet, piriet, of galeniet-tetraëdriet gekenmerk word, aangetref nie; tetraëdriet is ook nie in enigeen van die stibnietmonsters wat ondersoek is, aangetref nie. Nogtans lyk dit asof die opvallende ooreenkoms tussen die erts van Barberton en dié van die Murchisonreeks daarop dui dat hierdie ertse tot dieselfde metallogeniese tydperk behoort, en dit word gestaaf deur die feit dat die antimoonbevattende afsettings dwarsdeur die Gebied Barberton versprei is. Die goudvoorkomste van die Murchisonreeks wat sowat honderd-en-dertig myl noord van Barberton lê, is breedvoerig deur O. R. van Eeden, F. C. Partridge, en ander ([12]) beskryf. Verskeie tipes erts kom in daardie gebied voor, maar die minerale is nie op heeltemal dieselfde wyse as in die Gebied Barberton onder die tipes versprei nie. Tetraëdriet kom bv. in die stibnietdraende erts voor en nie in die loodbevattende erts nie. Die ooreenkoms van die mineraalgroepering met dié van die Barbertonse afsettings in die algemeen is merkwaardig, en selfs sulke betreklik skaars minerale soos berthieriet, koriniet, sinnaber, en enargiet (of famatiniet) is in beide gebiede verteenwoordig.

Net soos dié by Barberton, kom die Murchisonafsettings ook in Argeïese strata voor wat deur Argeïese basiese en granitiese gesteentes omring en binnegedring is en met graniet van die Nelspruittipe as die finale fase. Partridge verklaar dat „ the mineralisation in general (of the Murchison Range) then belongs to one metallogenic period ". Indien hierdie sienswyse reg is, kan daar verwag word dat 'n soortgelyke verwantskap ook tussen hierdie ertstipes in die Gebied Barberton bestaan.

* Die nommers van die monsters stem ooreen met dié in die vorige tabel, behalwe No. 0 wat 'n monster van konsentrate van Rosettamyn is en wat deur C. A. Strauss vir ontleding ingestuur is.

Hall ([2]) is of the opinion that the Nelspruit and Kaap Valley granites probably represent the same period but different conditions of consolidation; and that the gold mineralisation is related to their intrusion. It is now generally recognised that the Kaap Valley granite is older than the Nelspruit granite and van Eeden ([11]) thinks that while the bulk of the mineralisation is demonstrably connected with the intrusion of the Nelspruit granite, a small and unspecified part may be related to the older Kaap Valley intrusion and related Jamestown basic rocks. Strauss* has expressed the opinion that the mineralisation in the Rosetta Mine may antedate the intrusion of the Jamestown Complex and therefore that of the Kaap Valley granite.

The results of the present investigation accord with the view that the gold ores of Barberton are genetically related to one another and to the Nelspruit granite.

The ore of the Pilgrims Rest area belongs to a different metallogenic age. It occurs in rocks of the Transvaal System which are younger than the Nelspruit granite. Although the chief ore-minerals are the same as at Barberton, the texture is different and the deposits are characterised by the presence of *bismuth minerals*.

Ore formed at different temperatures is represented among the Barberton occurrences, and all the deposits seem to have originated at great to moderate depths. The high-, moderate-, and low-temperature types resemble Lindgren's hypothermal, mesothermal, and epithermal classes of deposits ([6]), but crustification, banding and other characteristics indicative of deposition near the surface, are absent.

The ore containing pyrrhotite and arsenopyrite of the New Consort and Lily Mines were formed at high temperatures and at great depth. The mineral assemblage (with the exception of arsenopyrite) resembles that of the magmatic sulphide deposits of the Bushveld Igneous Complex ([13]).

The pyritic deposits which constitute by far the largest proportion of the Barberton occurrences, are mineralogically uniform and simple and are characteristically hypothermal. The nature of the alteration of the country-rock associated with the pyrite deposits also indicates a hypothermal origin. The ore from Rosetta Mine (and to lesser extent that from Alfström and Alpine Mines) has a mineral assemblage characteristic of the mesothermal zone, and the belief that they belong to this zone is strengthened by the clear-cut contacts between the veins and the country-rock and a slight suggestion of banding of the ore-minerals (p. 30).

In attempting to assess the depth-zone to which the antimonial ore belongs the following facts have to be borne in mind:—

(1) At the New Consort Mine the antimonial ore is associated in the field with high-temperature mineralisation characterised by arsenopyrite and pyrrhotite. There too, stibnite was found associated with marcasite. However, as this association was found in weathered ore only, the deduction that the stibnite was formed at a low temperature, of which marcasite is usually considered indicative, would be very suspect. It is therefore thought probable that the antimonial ore was formed at a fairly high temperature.

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* C. A. Strauss: Unpublished report.

Hall ([2]) meen dat die Nelspruit- en Kaapvalleigraniet waarskynlik dieselfde tydperk, hoewel verskillende toestande van konsolidering verteenwoordig en dat die goudmineralisering met hulle indringing in verband staan. Daar word nou algemeen aanvaar dat die Kaapvalleigraniet ouer as die Nelspruitgraniet is en van Eeden ([11]) meen dat, hoewel daar aanduidings bestaan dat die grootste gedeelte van die mineralisering met die indringing van die Nelspruitgraniet in verband staan, 'n ongespesifiseerde gedeelte aan die ouer Kaapvallei-intrusie en verwante basiese gesteentes van die Jamestownkompleks verwant is. Strauss* het die mening uitgespreek dat die mineralisering in die Rosettamyn vóór die indringing van die Jamestownkompleks en dus ook van die Kaapvalleigraniet kon plaasgevind het.

Die resultate van die huidige ondersoek strook met die sienswyse dat die goudertse van Barberton geneties aan mekaar en aan die Nelspruitgraniet verwant is.

Die erts van die gebied Pelgrimsrus behoort tot 'n ander metallogeniese tydperk. Dit kom voor in gesteentes van die Sisteem Transvaal wat jonger as die Nelspruitgraniet is. Ofskoon die hoofertsminerale dieselfde is as by Barberton, is die tekstuur anders en word die afsettings deur die aanwesigheid van *bismutminerale* gekenmerk.

Erts wat by verskillende temperature gevorm is, is tussen die Barbertonse voorkomste verteenwoordig en dit wil voorkom asof al die afsettings op groot tot middelmatige dieptes ontstaan het. Die hoë-, middelmatige, en laetemperatuurtipes lyk na Lindgren se hipotermale, mesotermale en epitermale klasse afsettings ([6]), maar verkorsingsgestreeptheid en ander eienskappe wat op afsetting naby die oppervlakte dui, is afwesig.

Die erts van die myne New Consort en Lily wat pirrotiet en arseenpiriet bevat, is by hoë temperature en op groot dieptes gevorm. Die mineraalgroepering (met uitsondering van arseenpiriet) toon ooreenkoms met dié van die magmasulfiedafsettings van die Bosveldstollingskompleks ([13]).

Die piritiese afsettings wat verreweg die grootste gedeelte van die Barbertonse voorkomste uitmaak, is mineralogies uniform en eenvoudig en is kenmerkend hipotermaal. Die aard van die verandering van die newegesteente wat met die piriet geassosieer is, dui ook op 'n hipotermale oorsprong. Die erts van Rosettamyn (en in 'n mindere mate dié van die Alfström- en Alpinemyne) het 'n mineraalgroepering wat kenmerkend is van die mesotermale sone, en die mening dat hulle tot hierdie sone behoort, word gestaaf deur die duidelike kontakte tussen die are en die newegesteente en 'n geringe aanduiding van gestreeptheid van die ertsminerale (bl. 31).

Wanneer daar gepoog word om die dieptesone waartoe die antimoonbevattende erts behoort, te bepaal, moet daar op die volgende feite gelet word:—

(1) By die New Consortmyn is die antimoonbevattende erts in die veld geassosieer met hoëtemperatuurmineralisering wat deur arseenpiriet en pirrotiet gekenmerk word. Ook is gevind dat stibniet hier met markasiet geassosieer word. Aangesien hierdie assosiasie egter net in verweerde erts gevind is, moet die afleiding dat die stibniet by 'n lae temperatuur gevorm is, waarvan markasiet gewoonlik as 'n aanduiding beskou word, baie twyfelagtig wees. Dit is dus waarskynlik dat die antimoonbevattende erts by 'n taamlike hoë temperatuur gevorm is.

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* C. A. Strauss: Ongepubliseerde verslag.

(2) Although the antimonial ore may be located close to deposits of other types, stibnite is nevertheless segregated from the other minerals; nowhere has the writer found stibnite within pyrrhotite, pyrite, or galena. This suggests that the stibnite was formed during the waning phases of hydrothermal activity after the bulk of the other ore-minerals had been deposited, but of necessity in the same depth-zone.

It is envisaged that, as the magma and the intruded terrain cooled off, hydrothermal solutions could still emanate from progressively deeper zones of the granitic mass, and that two or more ages of high-temperature mineralisation can thus be developed in one ore-body. It is worthy of note that Partridge ([12]) although pointing out that the stibnite-bearing ore of the Murchison Range was later in age than the other ore found there, yet maintained that it was formed " under conditions . . . . . similar to those of high-temperature ore-deposition ".

The sulphidic minerals in the ore from Barberton appear to have been deposited in the following order:—

(i) The ore containing pyrrhotite and arsenopyrite:
(1) Arsenopyrite; (2) pyrrhotite; (3) chalcopyrite.

(ii) The pyritic ore:
(1) Arsenopyrite; (2) pyrite; (3) arsenopyrite (second generation); (4) pyrrhotite, chalcopyrite.

(iii) The lead-bearing ore:
(1) Pyrite; (2) sphalerite; (3) tetrahedrite; (4) chalcopyrite, galena.

In the antimonial ore, pyrite or arsenopyrite is an early mineral and is followed by berthierite and marcasite. The order of deposition of these two minerals could not be determined. Stibnite is the next mineral to form and is succeeded by metallic antimony.

Whenever gold was found it is a late mineral in the succession except perhaps in the case of the ore containing pyrrhotite and arsenopyrite where it was usually found enclosed in the latter sulphide.

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(2) Ofskoon die antimoonbevattende erts naby afsettings van ander tipes kan voorkom, is stibniet nogtans van die ander minerale afgesonder; die skrywer het nêrens stibniet in pirrotiet, piriet, of galeniet gevind nie. Dit laat die vermoede ontstaan dat die stibniet gedurende die afnemende fases van hidrotermale aktiwiteit gevorm is nadat die ander ertsminerale vir die grootste gedeelte afgeset was, maar noodsaaklikerwyse in dieselfde dieptesone.

Ons stel ons voor dat, terwyl die magma en die geïntrudeerde terrein besig was om af te koel, hidrotermale oplossings nog vanuit dieperwordende sones van die granietmassa kon te voorskyn kom, en dat twee of meer hoëtemperatuurmineraliseringstye op hierdie wyse in een ertsliggaam kon ontwikkel. Dit is van belang om daarop te let, dat ofskoon Partridge ([12]) daarop gewys het dat die stibnietdraende erts van die Murchisonreeks jonger is as die ander erts wat daar aangetref is, hy nogtans gekonstateer het dat dit gevorm is „ under conditions . . . . . similar to those of high-temperature ore-deposition ".

Dit wil voorkom of die sulfiedbevattende minerale in die erts van Barberton in die volgende volgorde afgeset is:—

(i) Die erts wat pirrotiet en arseenpiriet bevat:
(1) Arseenpiriet; (2) pirrotiet; (3) chalkopiriet.

(ii) Die piritiese erts:
(1) Arseenpiriet; (2) piriet; (3) arseenpiriet (tweede generasie); (4) pirrotiet, chalkopiriet.

(iii) Die loodbevattende erts:
(1) Piriet; (2) sfaleriet; (3) tetraëdriet; (4) chalkopiriet, galeniet.

In die antimoonbevattende erts is piriet of arseenpiriet 'n vroeë mineraal en word gevolg deur bertieriet en markasiet. Die afsettingsvolgorde van hierdie twee minerale kon nie bepaal word nie. Stibniet is die mineraal wat hierna gevorm is, en is gevolg deur gedeë antimoon.

In alle gevalle waar goud aangetref is, is dit 'n laat mineraal in die opeenvolging, behalwe miskien in die geval van die erts wat pirrotiet en arseenpiriet bevat, waar dit gewoonlik in laasgenoemde sulfied omsluit is.

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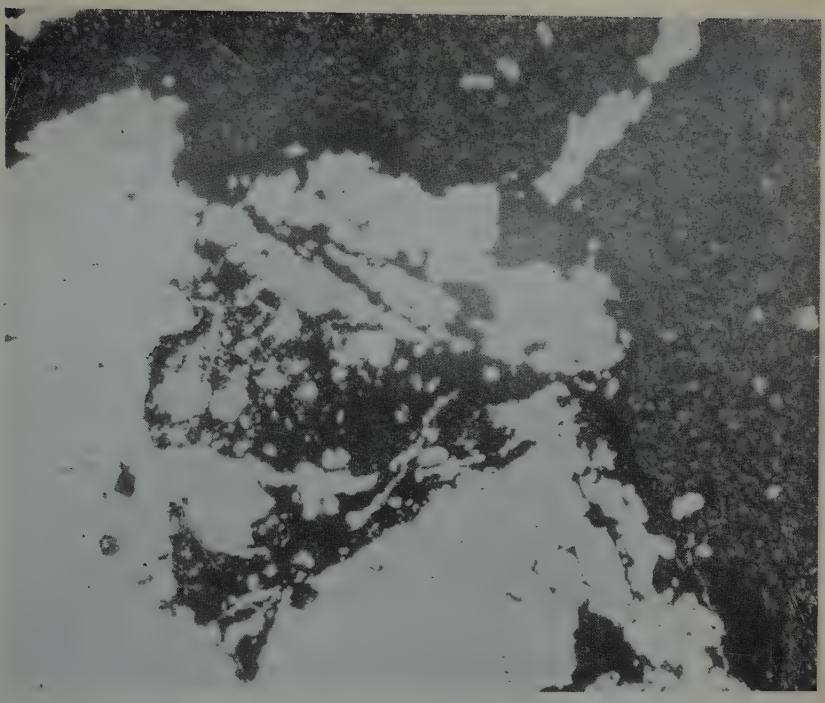

PLATE I.—Galena (black) replacing sphalerite (dark-gr. y) along the edges. White mineral is quartz. Rosetta Mine. Thin section magnified 39 diameters.

PLAAT I.—Galeniet (swart) wat sfaleriet (donkergrys) langs die rande vervang. Wit mineraal is kwarts. Rosettamyn. Slypplaatjie 39 diameters vergroot.

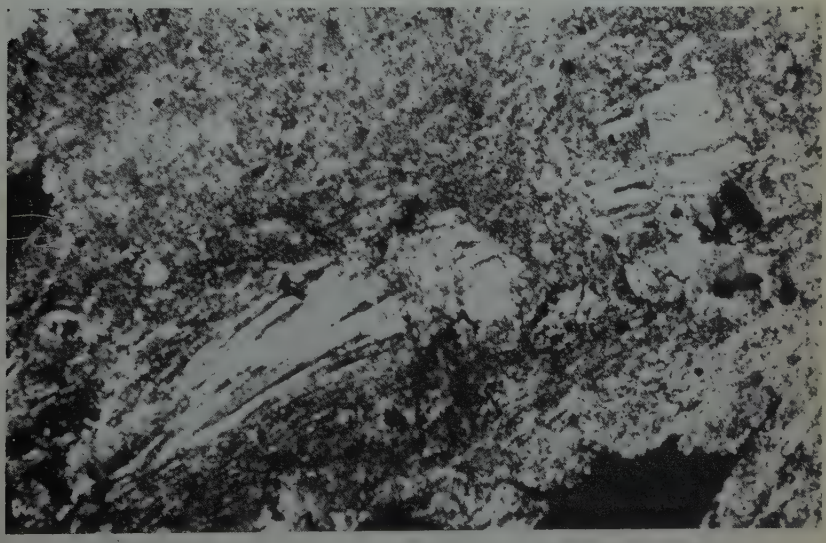

PLATE II.—Sheared quartz. Agnes Mine. Thin section magnified 39 diameters.

PLAAT II.—Geskuifskeurde kwarts. Agnesmyn. Slypplaatjie 39 diameters vergroot.

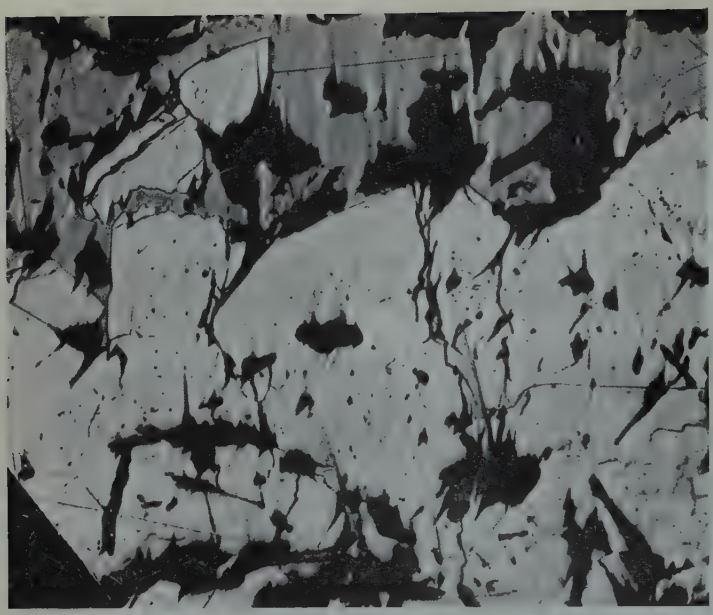

PLATE III.—Pyrrhotite (gray) in arsenopyrite (light-gray). New Consort Mine. Polished section magnified 146 diameters.

PLAAT III.—Pirrotiet (grys) in arseenpiriet (liggrys). New Consortmyn. Gepoleerde ertsstuk 146 diameters vergroot.

PLATE IV.—Pentlandite (white mineral in left centre and right top) in pyrrhotite. White crystal in left top is arsenopyrite. New Consort Mine. Polished section magnified 500 diameters.

PLAAT IV.—Pentlandiet (wit mineraal links in die middel en regs bo) in pirrotiet. Wit kristal links bo is arseenpiriet. New Consortmyn. Gepoleerde ertsstuk 500 diameters vergroot.

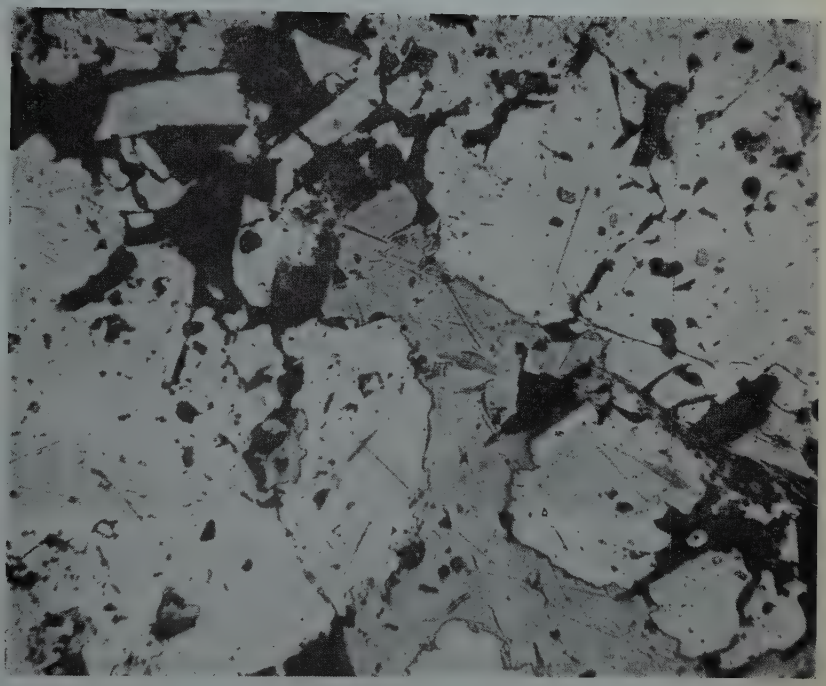

PLATE V.—Stibnite (gray) in marcasite (white). Broken crystals of arsenopyrite in top. New Consort Mine. Polished section magnified 146 diameters.

PLAAT V.—Stibniet (grys) in markasiet (wit). Gebreekte kristalle arseenpiriet bo. New Consortmyn. Gepoleerde ertsstuk 146 diameters vergroot.

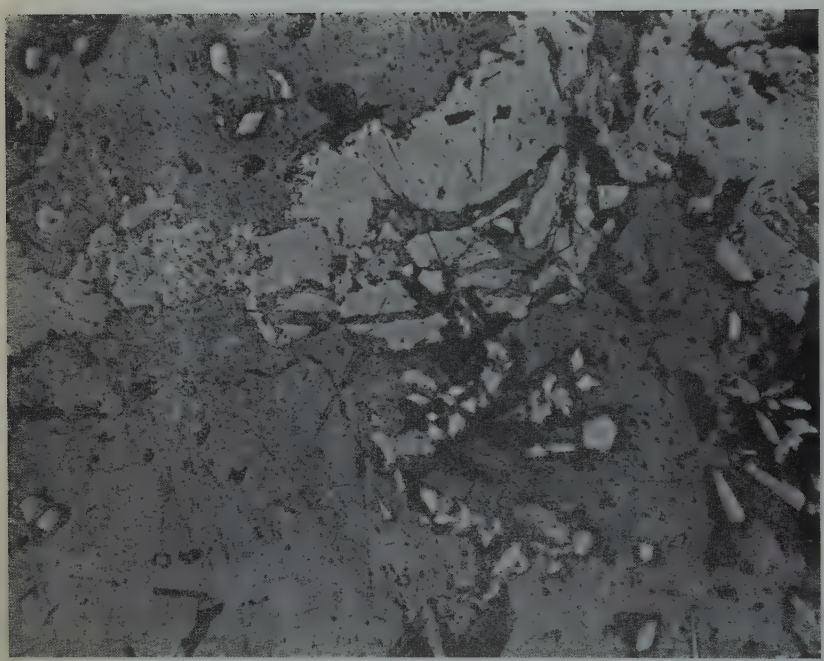

PLATE VI.—Veinlets of stibnite in marcasite. New Consort Mine. Polished section magnified 146 diameters.

PLAAT VI.—Stibnietaartjies in markasiet. New Consortmyn. Gepoleerde ertsstuk 146 diameters vergroot.

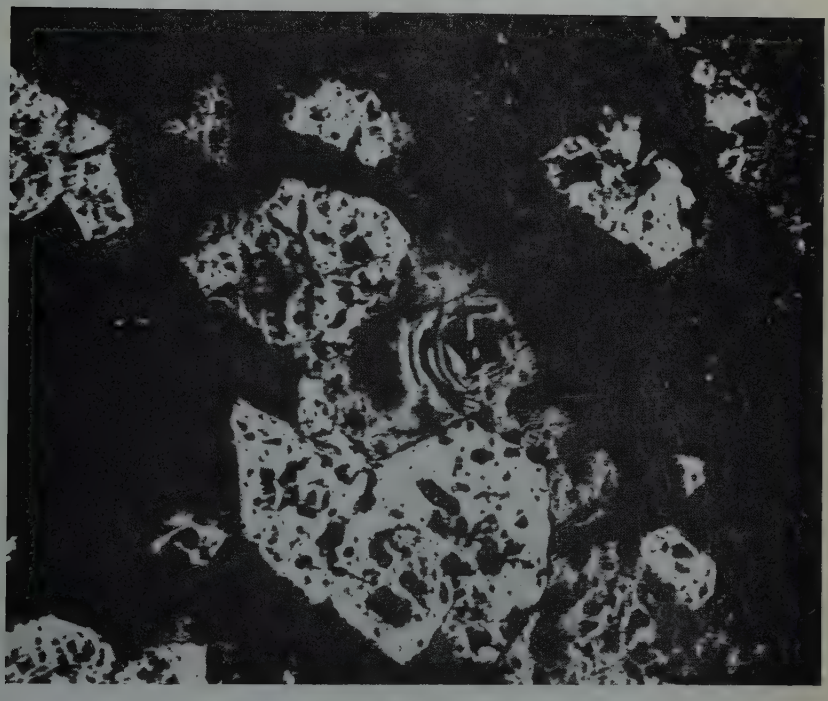

PLATE VII.—Melnikovite-pyrite (mineral in centre with concentric markings). White mineral is pyrite. Lily Mine. Polished section magnified 146 diameters.

PLAAT VII.—Melnikoviet-piriet (mineraal in die middel met konsentriese merke). Wit mineraal is piriet. Lilymyn. Gepoleerde ertsstuk 146 diameters vergroot.

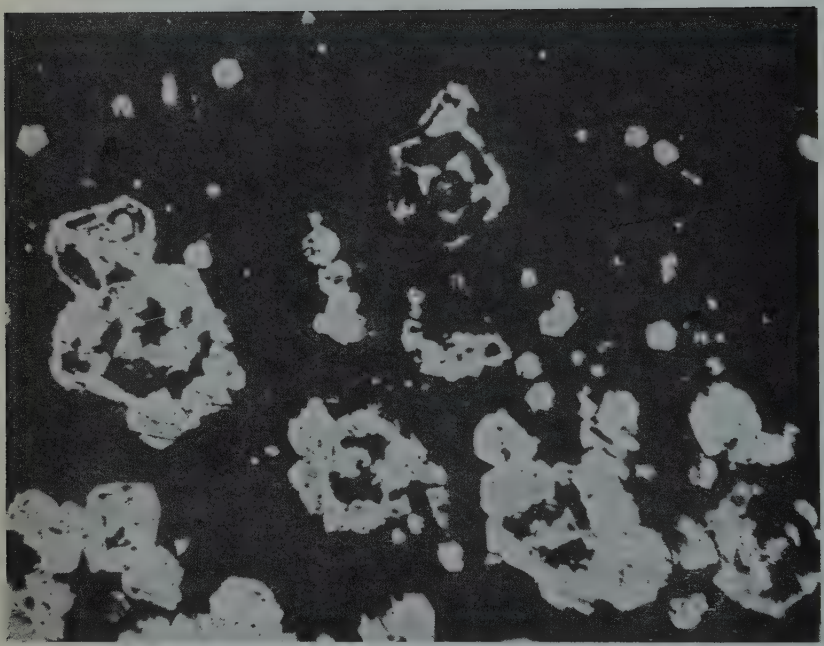

PLATE VIII.—Skeletal crystals of pyrite in quartz. Sheba Mine. Polished section magnified 146 diameters.

PLAAT VIII.—Skeletkristalle piriet in kwarts. Shebamyn. Gepoleerde ertsstuk 146 diameters vergroot.

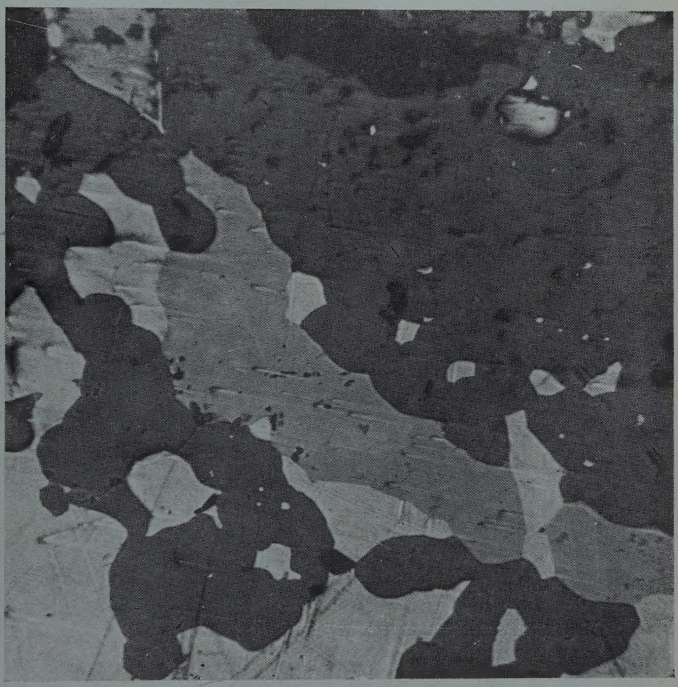

PLATE IX.—Sphalerite (dark-gray), tetrahedrite (light-gray), and galena (lightest gray). Rosetta Mine. Polished section magnified 146 diameters.

PLAAT IX.—Sfaleriet (donkergrys), tetraëdriet (liggrys), en galeniet (ligste grys). Rosetta-myn. Gepoleerde ertsstuk 146 diameters vergroot.

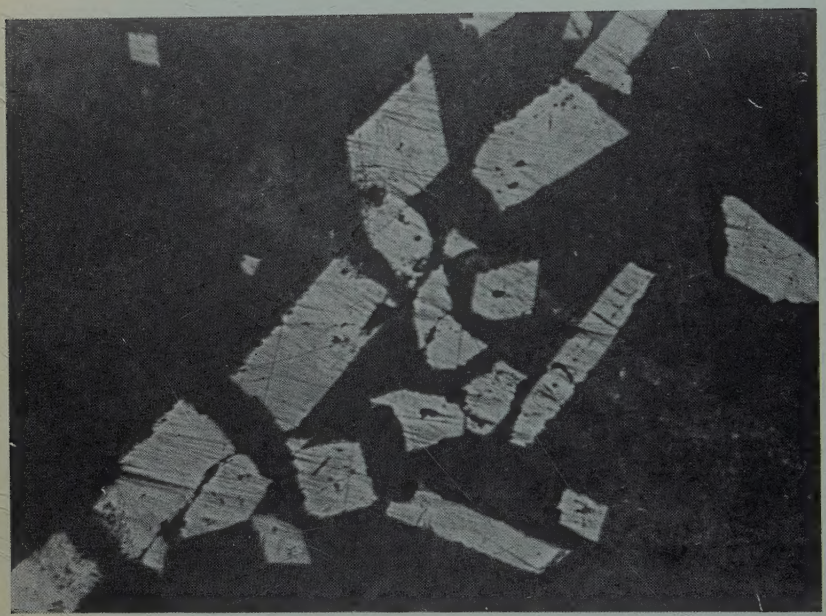

PLATE X.—Broken crystals of arsenopyrite in quartz. Fairview Mine. Polished section magnified 146 diameters.

PLAAT X.—Gebreekte kristalle arseenpiriet in kwarts. Fairviewmyn. Gepoleerde ertsstuk 146 diameters vergroot.